South Lake Champlain Basin 2 & 4 Tactical Basin Plan

December 2022

Tactical Basin Plan was prepared in accordance with 10 VSA § 1253(d), the Vermont Water Quality Standards[1], the Federal Clean Water Act and 40 CFR 130.6, and the Vermont Surface Water

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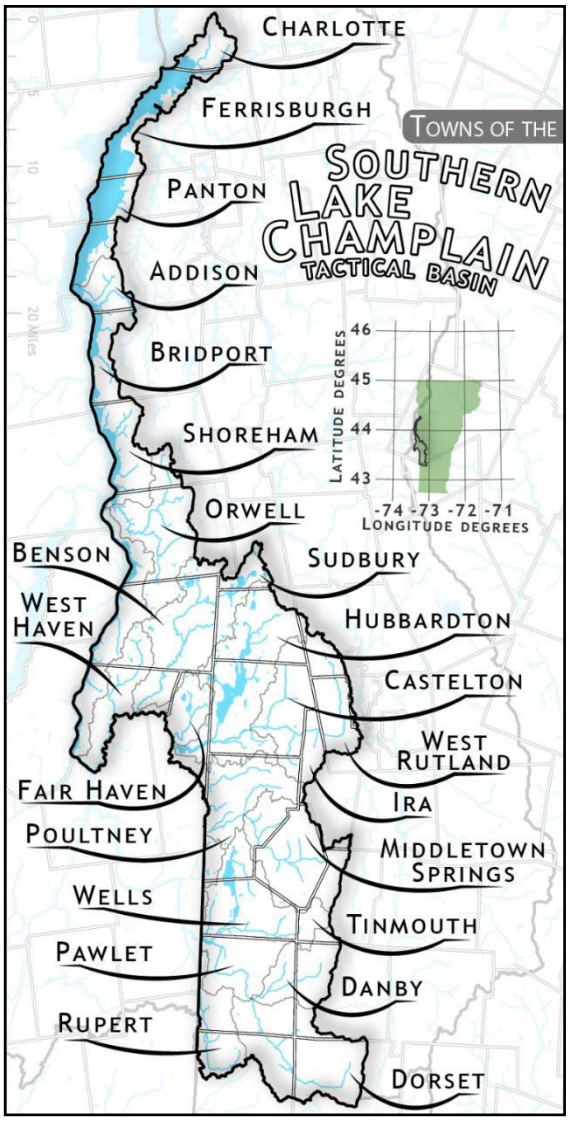
South Lake Champlain Basin Towns

Addison*	Ferrisburgh	Poultney
Benson	Hubbardton	Rupert*
Bridport*	Ira*	Shoreham
Castleton	Middletown	Sudbury
Charlotte*	Springs	Tinmouth
Danby	Orwell	Wells
Dorset	Panton*	West Haven
Fair Haven	Pawlet	West Rutland



**Only a very small area of the town is in the watershed and is covered in more detail in corresponding basin plans.*

Table of Contents

Executive Summary 1
What is a Tactical Basin Plan? 4
Chapter 1 – Basin Description and Conditions 5
A. Basin 2 & 4 Overview 5
B. Water Quality Conditions in Basin 2 & 4 10
Chapter 2 – Priority Areas for Surface Water Protection 25
A. Surface Water Classification 25
B. Surface Water Reclassification and Designation 26
C. Identification of Existing Uses 32
Chapter 3 – Priority Areas for Surface Water Restoration 34
A. Impaired Surface Waters 34
B. Basin Specific Total Maximum Daily Loads (TMDLs) 43
Chapter 4 – Strategies to Address Pollution by Sector 63
A. Agriculture 64
B. Developed Lands 66
C. Wastewater 76
D. Natural Resources 81
Chapter 5 – The Basin 2 & 4 Implementation Table 96
A. Progress in Basin 2 & 4 96
B. Coordination of Watershed Partners 96
C. Basin 2 & 4 Implementation Table 97
D. Basin 2 & 4 Monitoring and Assessment Table 111
List of Acronyms 115
Appendix A. Dams in Basin 2 & 4 121
Appendix B. Responsiveness Summary 124

List of Figures

Figure 1. Status of 67 strategies from the 2017 South Lake TBP. 3
Figure 2. The five major policy requirements that inform tactical basin planning. 4
Figure 3. Steps in the 5-year basin planning process. 4
Figure 4. Key roles of the five chapters in Vermont TBPs. 5
Figure 5. A map of the South Lake Champlain Basin divided into 15 smaller river basins. 6
Figure 6. Map of land cover estimates by acreage for the eleven sub-basins of Basin 2 & 4. 8
Figure 7. Map of the results of the Basin 2 & 4 bioassessment monitoring from 2013 to 2021. 13
Figure 8. Geomorphic condition of streams with Phase II stream geomorphic assessments. 16
Figure 9. Map of Vermont inland lake scorecard ratings showing condition of lakes and ponds of Basin 2 & 4. 18
Figure 10. Wetland locations in Basin 2 & 4 with completed Tier I assessments using the Vermont Rapid Assessment Method. 22
Figure 11. Map of a Basin 2 & 4 priority lake for protection. The map number corresponds with Table 6. 27
Figure 12. Map of Basin 2 & 4 priority rivers for protection. 29
Figure 13. Two-part map of Basin 2 & 4 impaired lakes 35
Figure 14. Two-part map of Basin 2 & 4 altered lakes 37
Figure 15. Map of Basin 2 & 4 impaired rivers 40
Figure 16. Map of Basin 2 & 4 altered rivers 42
Figure 17. Vermont sources of P loading to Lake Champlain segments, by land use; annual average of 2001-2010 45
Figure 18. Basin 2 & 4 TMDL 2036 target achieved annually for each sector from 2017 to 2021. 49
Figure 19. Achieved developed lands TP reductions and anticipated reductions from regulatory stormwater programs. The developed lands target reduction for Basin 2 & 4 is approximately 3,000 kg/yr. 58
Figure 20. An illustration of the land use sector framework and practices used in Tactical Basin Planning. 63
Figure 21. Acreage of field BMPs installed in Basin 2 & 4 from State FY2017-2021. 64
Figure 22. Basin 2 & 4 project priorities for roads based on REIs as part of the Municipal Road General Permit. 74
Figure 23. Recommended widths of shoreline vegetation for protection. 82
Figure 24. Hubbardton River Clayplain Preserve Project--Beaver dam analogues. 83
Figure 25. a) Ward Marsh mapping with 100-foot buffer delineated, b) Community mapping. 92
Figure A1. Map of dam records in Basin 2 & 4. 123

List of Tables

Table 1. Priority strategies and focus areas for protection and restoration in Basin 2 & 4 2
Table 2. Bioassessment results in Basin 2 & 4 from 2013 to 2021 13
Table 3. Lakes corresponding with Figure 9 showing lake scorecard ratings 19
Table 4. VRAM scores across Basin 2 & 4 23
Table 5. Four designated uses of waters by class. 25
Table 6. Lake(s) that may meet criteria for A(1) aesthetic use 28
Table 7. Rivers that may meet criteria for B(1) aquatic biota use 30
Table 8. Class A(2) designated public water sources in the Basin 2 & 4 30
Table 9. Basin 2 & 4 priority waters and pollutants 36
Table 10. List of altered lakes across Basin 2 & 4 38
Table 11. Table of impaired rivers across Basin 2 & 4 41
Table 12. Table of altered rivers across Basin 2 & 4 43
Table 13. Summary table of total phosphorus watershed annual loading, total annual reduction targets, and required reductions for Basin 2 & 4 47
Table 14. Summary table of estimated TP reductions per year for each sector by kilograms from 2017 to 2021. 48
Table 15. Prospective five-year and estimated final year (2036) total phosphorus reduction targets (kg/yr.) 50
Table 16. Phase 3 regulatory programs to meet phosphorus reductions. 51
Table 17. Towns with completed SWMPs and mapping reports (SMR) 69
Table 18. Basin 2 & 4 wastewater treatment facilities subject to NPDES Direct Discharge Permits 77
Table 19. Implementation strategies for the Basin 2 & 4 Tactical Basin Plan 99
Table 20. Basin 2 & 4 priorities for monitoring and assessment 111

Executive Summary

The South Lake Champlain Basin is comprised of Basin 2 (Poultney and Mettowee) and Basin 4 (direct tributaries to southern Lake Champlain). The Poultney River is 40 miles long and drains an area of 236 square miles and the Mettowee River is 17 miles long and drains an area of 137 square miles in Vermont. The basin occupies portions of Rutland, Addison, and Bennington counties. Basin 2 & 4 includes 23 towns and are roughly 56% forest, 19% agriculture, 8% surface waters, 8% wetlands, and 1.5% developed area including roads (NLCD, 2016).

The South Lake Champlain Tactical Basin Plan (TBP) provides a detailed description of current watershed conditions and identifies water quality strategies to protect and restore the basin's surface waters.

The South Lake Champlain Tactical Basin Plan describes current watershed conditions and identifies water quality strategies to protect and restore the basin's surface waters.

A total of four river segments, one lake, and two wetlands are priorities for protection as described in Chapter 2. Of these waters, one river is an Outstanding Resource Water (ORW), three river segments are reclassification candidates for aquatic biota, and one lake is reclassification candidate for aesthetics. Ward Marsh in West Haven has a pending petition as a Class I wetland and one wetland is recommended for additional study as a potential Class I candidate.

Although many of the monitored surface waters meet or exceed water quality standards, there are waters in need of restoration and continued monitoring. Four lakes and ponds are considered impaired and 15 are impacted by aquatic invasive species. Five river segments are considered impaired, four are impacted by aquatic invasive species, and one is considered altered by flow regime. Chapter 3 also includes progress reporting and target setting for Phase 3 of the Lake Champlain Phosphorus Total Maximum Daily Load (TMDL) Implementation Plan. The South Lake Basin inputs into the South Lake Champlain segments (A, B, and Port Henry) of Lake Champlain and thus, these segments are addressed.

Sector-based strategies are proposed to meet overall protection and restoration goals, as well as many strategies to achieve targets of the Lake Champlain Phosphorus TMDL. These strategies highlight actions to be carried out by watershed partners and the Basin's Clean Water Service Provider. The 62 spatially explicit strategies and 45 monitoring priorities are recommended for the next five years. Monitoring priorities have been identified to fill data gaps, track changes in water quality condition, and identify waters for reclassification and Class I wetland designation.

Target areas and strategies for protection and restoration are summarized by land use sector in Table 1.

Table 1. Priority strategies and focus areas for protection and restoration in Basin 2 & 4.

	Focus Areas	Priority Strategies
Agriculture	McKenzie Brook, East Creek, Hubbardton River, Hoisington Brook, Mettowee River	• Convene annual agricultural water quality partnership meetings. • Implement Nutrient Management Plans and agricultural Best Management Practices (BMPs) in priority watersheds. • Develop and implement clean water projects on agricultural lands (e.g., Wetland Restoration and Easements, River Corridor Easement, Stream Restoration Project, Riparian Buffer Projects) to help achieve the Lake Champlain P TMDL target reductions. • Develop and implement innovative projects on agricultural lands supported by VAAFM or CWSPs/BWQCs in consultation with VAAFM to help achieve Lake Champlain P TMDL target reductions. • Provide education, outreach, and technical assistance to agricultural communities in priority watersheds. • Support monitoring efforts to track results of practices applied in priority watersheds.
Developed Lands - Stormwater	Dorset, Poultney River SWMP (Benson, West Haven, Middletown Springs, Fair Haven), Castleton Headwaters SWMP (Ira and West Rutland), Lake Bomoseen SWMP (Hubbardton and Castleton), Flower Brook SWMP (Pawlet, Tinmouth, Danby), Lake St. Catherine LWAP	• Provide technical assistance and funding to develop and implement high priority projects from stormwater master plans (SWMPs) and Phosphorus Control Plans to help achieve the Lake Champlain P TMDL target reductions. • Provide information to municipalities on DEC standards and training opportunities for operations and maintenance of installed stormwater BMPs. • Encourage participation in the Green Schools Block Grant and support three-acre schools with funding and technical assistance for project development, implementation, and design. • Provide outreach to towns on and promote the adoption of Green Stormwater concepts. • Implement projects addressing vulnerabilities from flooding, severe rainstorms, and fluvial erosion from county and municipal All-Hazards Mitigation Plans.
Developed Lands - Roads	Castleton, Pawlet, Poultney, Wells, Benson, Hubbardton, Middletown Springs, Orwell, West Haven, and Tinmouth	• Provide support for towns and contractors to attend Road Roundtable Forums. • Develop and implement high priority road projects identified in Municipal Road General Permit (MRGP) road erosion inventories (REIs), lake watershed action plans (LWAPs), and SWMPs. • Support outreach and funding for MRGP equipment for towns. • Support training, outreach, and funding for equipment sharing programs.
Waste-water	Hubbardton River Trib. #7 below the Benson WWTF	• Provide technical assistance and funding to towns interested in exploring and implementing village wastewater systems and septic replacement. • Support and ensure monitoring and permit compliance for WWTFs.
Rivers	Castleton River, Mettowee River, Poultney-Hubbardton River, Poultney River tribs., and East Creek watersheds	• Provide technical assistance to help towns implement stronger protections for surface water in their town plans and municipal regulations. • Work with towns to increase their Emergency Relief Assistance Funds (ERAF) rating. • Develop and implement projects identified in Stream Geomorphic Assessments, River Corridor Plans, and Functioning Floodplain Initiative tool to achieve the Lake Champlain P TMDL target reductions. • Scope, design, and implement high priority bridge and culvert replacements to improve aquatic organism passage, stream geomorphic compatibility, and flood resilience.
Lakes	Lake St. Catherine and Little Lake, Lake Bomoseen, Lake Hortonia, Beebe Pond, Burr Pond, Sunrise and Sunset Lakes, Echo Lake	• Develop LWAPs and implement priority projects. • Implement high to medium priority projects identified in Lake SWMPs. • Maintain and build the capacity for existing aquatic invasive species programs. • Initiate stakeholder meetings to discuss fair to poor shoreland condition and Lake Wise Assessments on target shoreline properties. • Support lay monitoring and tributary monitoring in lakes with increasing nutrient trends. • Support Wastewater workshops (formerly Septic Socials).

Wetlands	South Fork of East Creek watershed, Addison, Ferrisburgh, Bridport, Orwell, Shoreham	• Provide outreach and technical assistance for Class I wetland assessment, stakeholder discussions, and petition development where there is interest. • Increase wetland size and function through restoration of wetlands. Prioritization of sites will be informed by the Wetland Restoration Potential scores on the ANR Atlas and assessments. • Provide support to the Wetlands Program by publicizing volunteer wetland mapping workshops and training for the public.
Forests	Flower Brook watershed, Headwaters of Castleton, Poultney, and Mettowee Rivers, Lake St. Catherine (Lake St. Catherine State Park), Lake Bomoseen (Bomoseen State Park), Half Moon Pond (Half Moon Pond State Park), Pond Woods WMA	• Develop forestland focused workgroups in priority watersheds to meet the Lake Champlain P TMDL target reductions. • Implement forestry Acceptable Management Practices (AMPs) and natural resource restoration and conservation projects on state and private lands. • Maintain and increase UVA enrolled forestland among eligible parcels by providing outreach and technical assistance to private landowners, foresters, and loggers to equip them with tools to apply, enroll, and manage forestland in accordance with program standards, including implementation of AMPs.

The 2017 Basin 2 & 4 plan identified 67 strategies to address protection and restoration of surface waters. Of the 67 strategies identified, 16 are complete, 12 are in progress, 35 are ongoing, 4 are awaiting action, and 0 have been discontinued[1] (Figure 1). The Basin 2 & 4 report card, to be included in the Vermont Clean Water Initiative 2022 Performance Report, will include a list of detailed updates for each strategy identified in the 2017 Plan. Several strategies are also carried over to this plan.

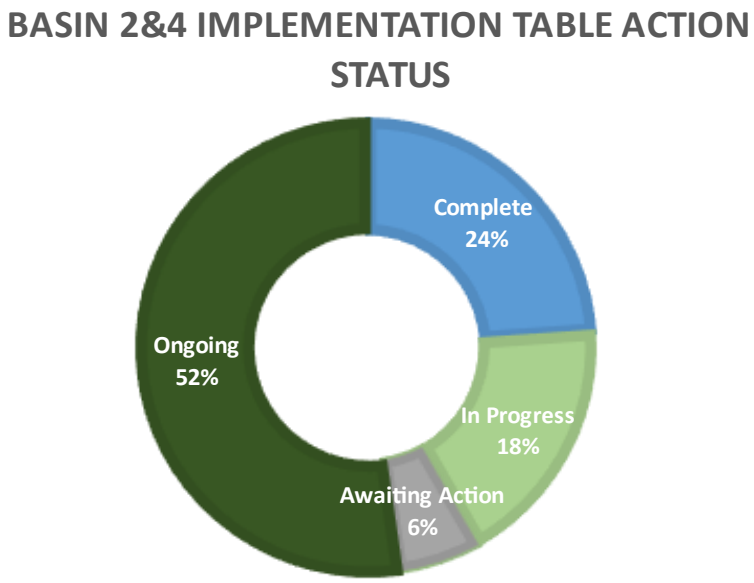


Figure 1. Status of 67 strategies from the 2017 South Lake TBP.

The 62 strategies in this plan reflect input from the public, state and federal water quality staff, sector-based workgroups, watershed groups, and regional planning commissions.

Water quality improvements in Basin 2 & 4 are hastened by new regulatory and non-regulatory programs. Vermont's Clean Water Service Delivery Act of 2019 prioritizes program delivery and funds for non-regulatory projects identified in TBPs including sub-jurisdictional stormwater management practices, natural resource restoration projects such as floodplain reconnections, wetlands restoration, forestland best management practices, and forested riparian buffer restoration. Implementing and tracking these projects is essential to achieve the water quality goals spelled out in the Lake Champlain and Lake Memphremagog TMDLs. New and expanded collaboration through the Clean Water Service Providers (CWSP) and state regulatory programs will continue to fill gaps though future iterations of the phased TMDL implementation plans. In SFY 2022 and SFY 2023, the State of Vermont allocated over $200 million in American Rescue Plan Act (ARPA) funds for clean water infrastructure. These monies are being invested in water and sewer infrastructure to help address funding gaps and water quality needs. Of relevance to this TBP, funds include statewide appropriations for three-acre stormwater ($30 million), combined sewer overflows ($30 million), nonpoint source projects ($30 million), floodplain buyouts ($15 million), and wastewater pre-treatment ($7 million).

[1] Discontinued = strategies that have not been initiated and are no longer being pursued. Awaiting action = strategies that have not been initiated for various reasons such as a lack of resources or local support.

What is a Tactical Basin Plan?

A Tactical Basin Plan (TBP) is a strategic guidebook produced by the ANR to protect and restore Vermont's surface waters. TBPs propose strategies and prioritize resources that will have the greatest influence on surface water protection or restoration. TBPs are integral to meeting a broad array of both state and federal requirements (Figure 2) including the EPA's 9-element framework for watershed plans (Environmental Protection Agency, 2008) and state statutory obligations including those in the VT Clean Water Act, Act 76, and 10 V.S.A. § 1253.

Figure 2. The five major policy requirements that inform tactical basin planning.

Tactical basin planning is carried out by the Water Investment Division (WID) in collaboration with the Watershed Management Division (WSMD) and in partnership with state agencies, federal, regional, and local governments, watershed organizations and stakeholders, and academic institutions. The partnerships support the Agency's programs through ideation, understanding of local water quality issues, and commitment to implementing solutions.

The TBP water quality goals, objectives, strategies, and projects aim to protect public health and safety and ensure public use and enjoyment of Vermont waters and their ecological health as set forward in the Vermont Surface Water Management Strategy (VSWMS) and the Vermont Water Quality Standards (VWQS). The TBP process (Figure 3) allows for the issuance of plans for Vermont's 15 basins every five years.

Chapters 1-4 in the TBP describe water quality in the basin, protection and restoration priorities, and sector specific water quality efforts. This information supports the targeted strategies listed in the implementation table in Chapter 5 (Figure 4).

Figure 3. Steps in the 5-year basin planning process.

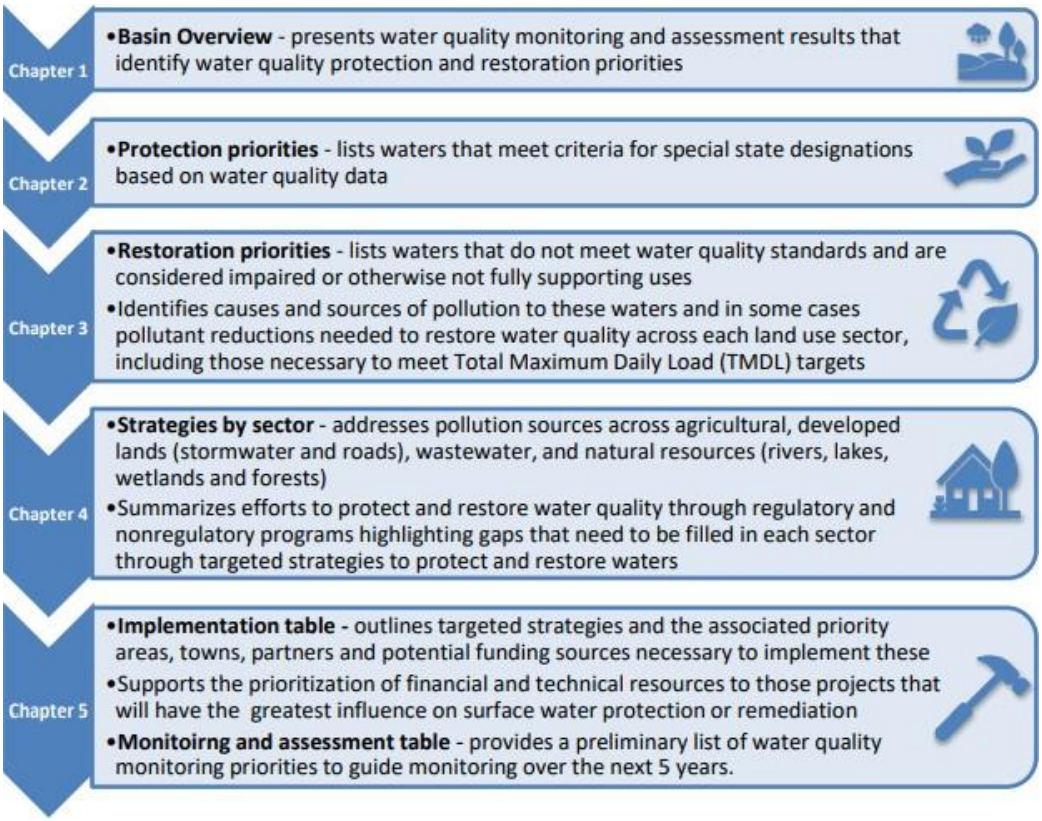


Figure 4. Key roles of the five chapters in Vermont TBPs.

The 2022 South Lake Champlain TBP identifies strategies that help ANR and its partners prioritize activities for the next five years. These strategies inform individual projects identified and tracked in the Watershed Projects Database (WPD) and viewed in the Watershed Project Explorer. Both are found on ANR's Clean Water Portal and are continuously updated to capture project information throughout the TBP process.

Chapter 1 – Basin Description and Conditions

A. Basin 2 & 4 Overview

The South Lake Champlain Basin (Basin 2 & 4) encompasses 498 square miles in Vermont. The entire watershed spans 23 towns draining portions of Addison, Bennington, and Rutland Counties. The river basin[2] comprises 15 sub-basins (Figure 5), which include the Poultney River, East Creek, Hubbardton River, Castleton River, and many other tributaries.

[2] A river basin is an area of land drained by a river and its tributaries. The terms 'basin' and 'watershed' are used interchangeably in this report. The South Lake Champlain Basin is also referred to as Basin 2 & 4.

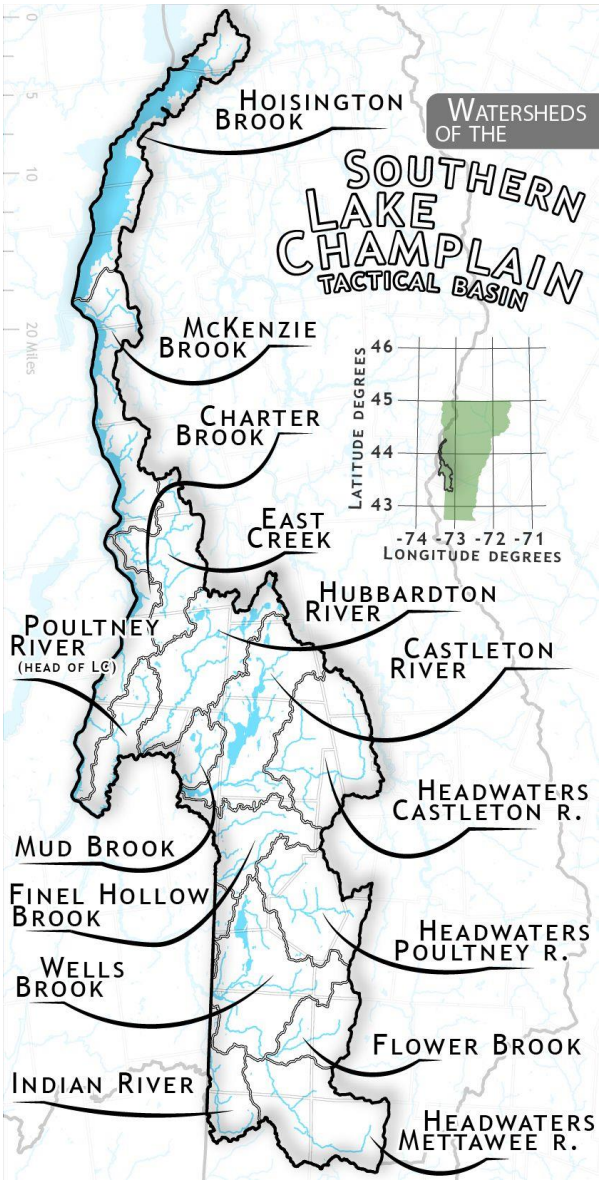


Figure 5. A map of the South Lake Champlain Basin divided into 15 smaller river basins.

Detailed information about each of these rivers and other smaller watersheds within Basin 2 & 4 can be found in the individual basin assessment reports for the basin and the 2017 South Lake Champlain TBP.

There are a total of 28 lakes and ponds that are 20 acres or larger in the South Lake Champlain Basin. Lake Bomoseen, Lake St. Catherine, and Lake Hortonia are by far the largest with surface areas of 2,425, 885, and 500 acres, respectively. More information on lakes and their conditions can be found in Section B of this Chapter.

Land Use and Land Cover

The South Lake Champlain Basin is a predominantly forested landscape. Forested land covers about

56% of the basin while about 8% is wetlands and 8% is open water. Developed and agricultural land uses comprise about 1.5% and 19% of the basin, respectively (Figure 6).

Large areas of properly managed forests, riparian buffers, and wetlands are principally responsible for the good water quality in the basin. Where good management practices and quality local stewardship exist on agricultural and developed lands, good water quality will too. The areas in Basins 2 & 4 that are experiencing degraded water quality trends are adjacent to:

- concentrated residential areas with untreated stormwater runoff and road development (Castleton River, Poultney River, Lake Bomoseen, Lake St. Catherine);
- concentrated agricultural land (Mettowee River, Flower Brook confluence downstream 4.3 miles, Hubbardton River Trib. #7, below WWTF);
- dams (North Breton Brook, Austin Pond, Lake Bomoseen, Mettowee River, Pond Hill Brook); and
- historic landfill site (West Pawlet-Unnamed Trib. to Indian River).

Most forestlands are in the tributary headwaters of the Castleton, Poultney, and Mettowee Rivers, while most agricultural lands are located along the McKenzie Brook, East Creek, and the Mettowee River Valley, with concentrated development in villages and town centers. A large portion of road networks are located along tributaries and the mainstem of the Castleton and Poultney Rivers. Large wetland complexes are found around lakes and floodplains along rivers and streams that have not been developed or drained.

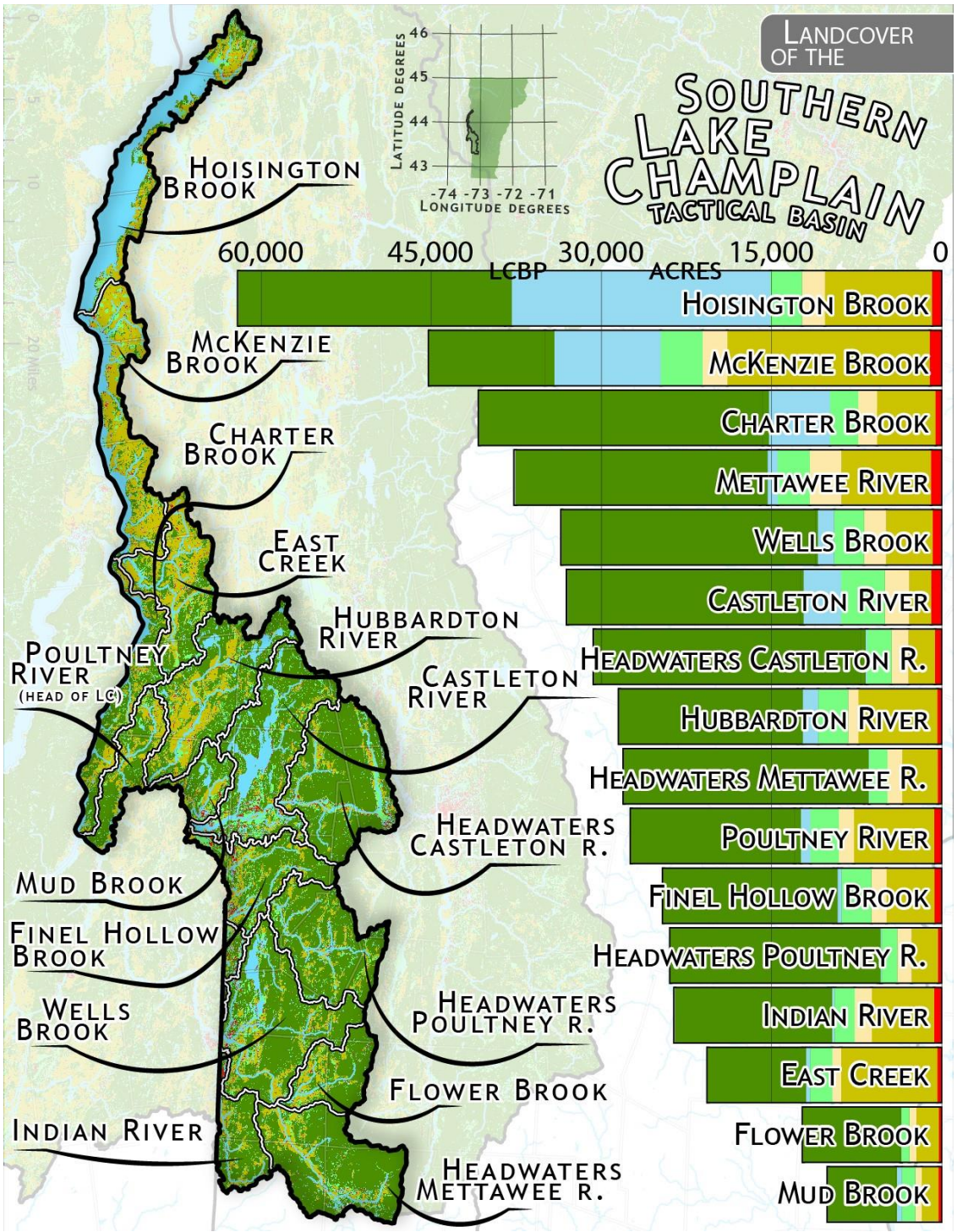


Figure 6. Map of land cover estimates by acreage for the eleven sub-basins of Basin 2 & 4. Green = forest, Blue = Open Water, Light Green = Wetland, Pink = Herbaceous, Brown = Agriculture, and Red = Developed (Source: 2016 LULC dataset).

Both regulatory and non-regulatory management of land uses are required to reduce and prevent discharge of polluted runoff to improve and protect water quality. Federal and state licensing are chiefly responsible for mitigating chemical, physical, and biological impacts of dam operation. The Federal Clean Air Act is largely responsible for mitigating impacts from acid deposition. The Hazardous Waste Management Program is responsible for remediation of surface water pollution from hazardous waste sites and landfills. The Stormwater Program is responsible for managing regulated discharges from stormwater. The VAAFM is responsible for regulating jurisdictional farm activities. Most importantly, the Federal Clean Water Act confers authority to states under the National Point Source Discharge Elimination System (NPDES) to manage wastewater and stormwater discharges to ensure that surface waters meet the goals and criteria of state water quality standards. NPDES permits in Vermont impose requirements for pollution control in wastewater facilities, and NPDES and state stormwater permits impose treatment requirements for precipitation-driven discharges. The ANR recently updated and reissued the NPDES General Permit for medium concentrated animal feeding operations (Medium CAFOs). This General Permit was originally issued in 2013 and set conditions for the discharge of pollutants from Medium CAFOs to waters of the state. Surface water pollution is also mitigated through the voluntary actions recommended in this plan.

Climate Change Implications for Water Resource Management

Adapting our management and use of surface waters in the face of climate change is one of the main challenges for Basin 2 & 4 (State of Vermont, 2021). Climate is defined by long-term weather patterns, which in turn influence human and natural systems. In Vermont, climate change is causing increases in storm intensity and total precipitation (Betts, 2011) (National Oceanic and Atmospheric Administration, 2013). These increases will likely lead to a rise in flooding, water quality and ecosystem impairments, and reduced water-based recreational availability to Vermonters (Pealer & Dunnington, 2011).

The 2021 Vermont Climate Assessment includes state-level climate change information and implications for local surface waters. Vermont's average annual temperature has increased by almost 2°F (1.11°C) since 1900 with warming occurring twice as fast in winter (Galford, 2021). The latter results in earlier thaw dates for rivers, lakes and ponds, and mountain snowpack. Average annual precipitation has increased by 21% since 1900 and average annual stream flows are increasing, which is expected to continue in the future (Galford, 2021). High flows now happen more frequently, increasing flood inundation and stream-related erosion, both of which can be exacerbated or alleviated by land-use management decisions.

Aquatic habitats affected by increased runoff and streamflow could experience increases in sediment mobilization, nutrients, and scouring in addition to increased water temperature. In response, local freshwater plant and animal species may shift their geographic ranges and alter their abundance and seasonal activities (Stamp J, 2020).

Maintaining habitat connectivity, river and lake riparian buffers, and stream equilibrium conditions will help reduce the impacts of climate change on Vermont's rivers, lakes and ponds, and wetlands.

The 2021 Vermont Climate Assessment suggests extreme weather events such as droughts and floods are expected to continue to increase with climate change. Vermont experiences 2.4 more days of heavy precipitation than in the 1960s, typically in summer.

Protective measures, such as strategic land acquisition and limitations on development in riparian areas, may be the most economical solution to address the challenges presented by climate change and to achieve healthy surface waters (Watson, Ricketts, Galford, Polasky, & O'Neil-Dunne, 2016) (Weiskel, 2007). But where pollution from historic and current land use occurs, strategies identified in this plan complement protective measures, such as river corridor easements, riparian area plantings, floodplain and wetland restoration, dam removals, and agriculture, forestry, and stormwater best management practices. Federal, state, and local partners are coordinating to implement these strategies. Additional information on climate change in Vermont can be found at: https://climatechange.vermont.gov.

B. Water Quality Conditions in Basin 2 & 4

Water quality monitoring and assessments that are supported by VDEC and its partners are described in detail in the Water Quality Monitoring Program Strategy and provide a window into the condition of a basin's waters. Most of the active monitoring is led by programs in the WSMD and include the Monitoring and Assessment Program (MAP). The results of this work offer a snapshot of the condition of a basin's waters. Monitoring programs in this basin include:

- The Biomonitoring and Aquatic Studies Section (BASS) implements the Ambient Biomonitoring Network (ABN) which focuses on biological monitoring of macroinvertebrate and fish communities, targeted water chemistry, and temperature monitoring. BASS assesses the aquatic biota and wildlife designated use according to the VWQS for wadeable rivers and streams. Biomonitoring staff also support the LaRosa Partnership Program (LPP), a community science water quality monitoring program. The Poultney Mettowee Natural Resources Conservation District (PMNRCD) participates in LPP by sampling streams throughout this basin and conducting targeted monitoring for pollutant tracking and BMP implementation.
- The VDEC Rivers Program supports stream geomorphic assessments that evaluate geomorphic and physical habitat conditions of rivers. The Lakes and Ponds Program supports the Spring Phosphorus and Lay Monitoring Programs, which evaluate nutrient conditions and trends on lakes, as well as shoreland condition, and more in-depth lake assessments in addition to surveys for aquatic invasive species. Additionally, the Wetlands Program conducts biological assessments on the functions and values of wetlands.
- The Vermont Fish and Wildlife Department (VFWD) conducts fishery assessments and temperature monitoring to understand and protect recreational fish populations and evaluates streams for strategic wood addition to restore habitat.

- A network of streamflow gages is funded and operated in partnership among VDEC, Vermont Agency of Transportation (VAOT) and Vermont Department of Public Safety (VDPS).
- Statewide pesticide monitoring is conducted by the VAAFM with sampling sites throughout Vermont. VAAFM also runs the Ambient Surface Water Study (ASWS) to establish baseline levels of pollutants and to monitor for the presence of neonicotinoids, glyphosate, corn herbicides, and nitrate in Lake Champlain and its contributing tributaries[3].
- Per- and Polyfluoroalkyl Substances (PFAS) are monitored by the Drinking and Groundwater Protection Division, while WSMD oversees monitoring of PFAS in surface waters and direct discharges. Tactical Basin Plans include monitoring information reported by Vermont State agencies as results relate to the designated uses defined by the Vermont Water Quality Standards.

Condition of Rivers and Streams

Biological Assessment

The WSMD assesses the health of a waterbody using biological, chemical, and physical criteria described in the Vermont Water Quality Monitoring Program Strategy 2011-2020. WSMD uses a 5-year rotational monitoring schema for the basins and maintains 12 sentinel sites statewide, which are monitored annually. Sentinel sites have negligible prospects for development or land use change and are closely monitored to isolate long-term impacts related to climate change. Most of these data can be accessed through the Vermont Integrated Watershed Information System (IWIS) online data portal.

Biomonitoring is used to detect stressors, impairments, and their severity relative to the to the VWQS designated use of Aquatic Biota and Wildlife. It also identifies streams that meet or exceed a higher classification for this designated use. Macroinvertebrate and fish communities are rated from *Poor* - not meeting Vermont's Water Quality Standards (VWQS) - to *Excellent*. If a stream repeatedly fails to meet the minimum standards for its classification, it would be listed as impaired on the State of VT priority waters list. The most recent monitoring information was collected in Basin 2 & 4 from 2017 to 2021 (Figure 7, Table 2). Figure 7 and Table 2 show data collected within the last 10 years, which may be used to identify waters that are reclassification priorities.

Macroinvertebrate Monitoring Results

A total of 45 macroinvertebrate assessments were completed between 2013 and 2021 in Basin 2 & 4 (Figure 7, Table 2). The results of the assessments are described below. In addition, to ensure a comprehensive understanding of water quality basin wide, a gap analysis was conducted by VDEC to identify sites without current monitoring data. These will be prioritized for the 2024 monitoring season and can be found in Chapter 5 in the Basin 2 & 4 Monitoring and Assessment Table.

[3] Since 2014, VAAFM has collected 646 water samples at 34 sites in agricultural use areas throughout the state.

Of the 45 macroinvertebrate assessments, 22 monitoring sites (49%) exhibited *Very Good* or better condition. Of these, nine (20%) were found to be *Excellent,* meaning their macroinvertebrate community is at reference or natural condition. These streams include Sykes Hollow Brook, Mettowee River, Lewis Brook, Coggman Creek, Giddings Brook, Hubbardton River, Wells Brook, North Brook, and Lavery Brook. Most of these waters are either headwater streams or located higher up in the watershed. Thirteen (29%) were found to be in *Very Good to Very Good-Excellent* condition. These streams include Beaver Brook, Flower Brook, Indian River, North Breton Brook (RM 0.6 and 1.5), Poultney River, Mettowee River (RM 20.0 and 23.6), Castleton River (RM 6.0 and 6.5), Breese Pond Outlet, Benson Landing Tributary, and Big Brook. Streams in *Very Good* or better condition exceed the VWQS criteria for B(2) classification and are priorities for additional assessment and protection.

Nine (20%) macroinvertebrate assessments scored *Good* which meets B(2) criteria. These waters include the Poultney River (RM 30.1, 24.1, 23.1, 23.0), Castleton River, Hubbardton River (RM 1.8, 7.1, 12.9), and South Brook. Streams in *Good* condition meet the VWQS and are priorities for maintenance and protection.

The Poultney River, Vail Brook, and Sucker Brook sites were in *Fair-Good* condition. Sites in *Fair-Good* condition are considered indeterminant for assessing water quality condition. These sites do not fully meet the VWQS, but more monitoring is required to determine their status. Six sites were in *Fair-Poor* to *Fair* condition, Hubbardton River Trib. 7 (RM 2.2, 2.6, 2.8), Pond Hill Brook, Bump School Brook, and Braisted Brook. Sites in *Fair* to *Poor* condition do not meet the VWQS and need to be considered for additional assessment, listing, stressor source identification monitoring, and restoration.

Fish Monitoring Results

Twenty six fish sampling events occurred in Basin 2 & 4 from 2013 through 2021 (Figure 7, Table 2). Two of these 26 sampling events were deemed *Unable to Assess* due to abnormally low flow conditions (Bump School Brook in 2019 and Braisted Brook in 2021). Of the 24 fish surveys assessed, 10 (42%) had fish communities in *Very Good* condition which indicate the fish communities at these sites exceed the VWQS for class B(2) streams. The streams include Wells Brook, Lavery Brook, Mettowee River (2016 and 2017), Sykes Hollow Brook, Beaver Brook, Lewis Brook, Castleton River, and North Breton Brook (RM 0.6 and 1.5). Streams in *Very Good* or better condition are priorities for additional assessment and protection.

Eleven (46%) fish assessments exhibited communities in *Good* condition at Giddings Brook, Poultney River (RM 21.8, 24.1, 30.1, and 32.9), North Brook, South Brook, Braisted Brook, Flower Brook, and East Creek North Fork (2013, 2015). Streams in *Good* condition meet the VWQS for class B(2) streams and are priorities for maintenance and protection.

There were three (13%) fish assessments with communities in *Fair* or *Poor* condition. These were Beaver Brook, Hubbardton River, and Big Brook. Sites in *Fair* or *Poor* condition do not meet the VWQS and need to be considered for additional assessment, listing, source identification monitoring, and restoration.

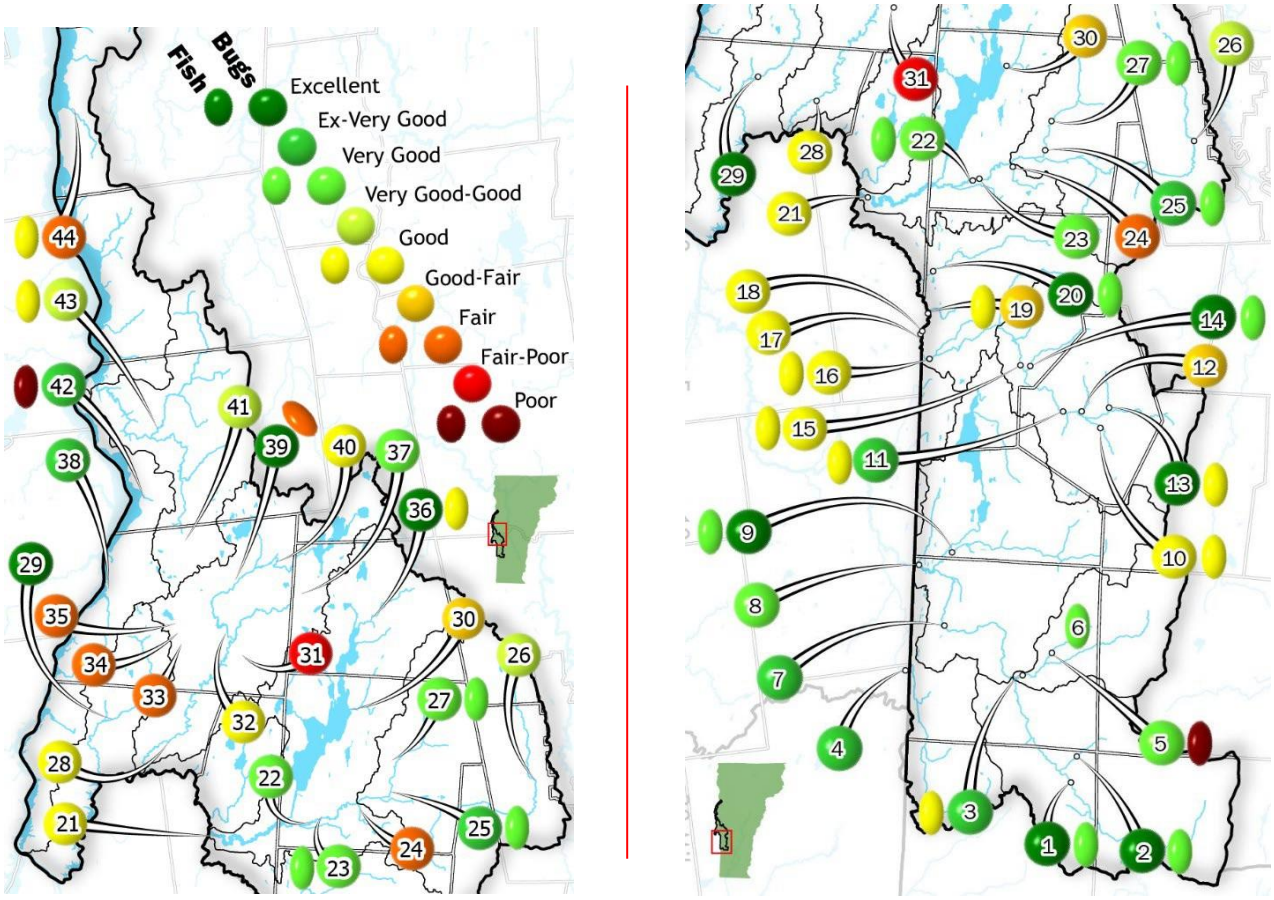


Figure 7. Map showing the results of the Basin 2 & 4 bioassessment monitoring from 2013 to 2021.

Table 2. Bioassessment results in Basin 2 & 4 from 2013 to 2021. Map ID corresponds to the map above. Exc = Excellent, Vgood = Very good. *Mettawee and Mettowee are used interchangeably in the plan.

Map ID	Stream Name, River Mile	Year	Bug Assessment	Fish Assessment
1	Mettawee* River, 32.5	2016, 2017	Exc, Exc	Vgood, Vgood
2	Sykes Hollow Brook, 0.9	2015, 2016	Exc/Vgood, Exc	Vgood, Exc
3	Flower Brook, 0.5	2019	Exc-Vgood	Good
4	Indian River, 6.7	2015, 2019	Vgood, Exc-Vgood	
5	Beaver Brook, 0.2	2015	Vgood	Poor
6	Beaver Brook, 1.8	2016		Vgood
7	Mettawee River, 23.6	2015	Exc-Vgood	
8	Mettawee River, 20.0	2019	Vgood	
9	Wells Brook, 1.3	2019	Exc	Vgood
10	South Brook, 0.7	2019	Good	Good
11	Poultney River, 32.9	2019	Exc-Vgood	Good

12	Vail Brook, 0.2	2019	Good-Fair	
13	North Brook, 0.2	2019	Exc	Good
14	Lavery Brook, 0.3	2019	Exc	Vgood
15	Poultney River, 30.1	2016	Good	Good
16	Poultney River, 24.1	2018	Good	Good
17	Poultney River, 23.1	2015, 2018	Good, Good	
18	Poultney River, 23.0	2018	Good	
19	Poultney River, 21.8	2015	Good-Fair	Good
20	Lewis Brook, 0.5	2015	Exc	Vgood
21	Castleton River, 0.5	2015	Good	
22	Castleton River, 6.0	2015	Vgood	Vgood
23	Castleton River, 6.5	2015	Vgood	
24	Pond Hill Brook, 0.2	2019	Fair	
25	North Breton Brook, 0.6	2019	Exc-Vgood	Vgood
26	Castleton River, 18.1	2015	Vgood-Good	
27	North Breton Brook, 1.5	2015, 2016	Vgood, Vgood	Vgood, Vgood
28	Hubbardton River, 1.8	2016	Good	
29	Coggman Creek, 2.9	2015	Exc	
30	Sucker Brook, 0.1	2019	Good-Fair	
31	Bump School Brook, 0.8	2019	Fair-Poor	
32	Hubbardton River, 7.1	2019	Good	
33	Hubbardton River Trib 7, 2.2	2015	Fair	
34	Hubbardton River Trib 7, 2.6	2018	Fair	
35	Hubbardton River Trib 7, 2.8	2018	Fair	
36	Giddings Brook, 1.1	2015	Exc	Good
37	Breese Pond Outlet, 4.7	2015	Vgood	
38	Benson Landing Tributary, 0.4	2013	Exc-Vgood	
39	Hubbardton River, 10.9	2016	Exc	Fair
40	Hubbardton River, 12.9	2015	Good	
41	East Creek South Fork, 5.4	2015	Vgood-Good	
42	Big Brook, 0.2	2013	Exc-Vgood	Poor
43	East Creek North Fork, 0.7	2013, 2015	Vgood-Good	Good
44	Braisted Brook, 0.2	2019	Fair	Good

Stream Geomorphic Assessments

The coverage of Phase I or Phase II Stream Geomorphic Assessments (SGAs) in Basin 2 & 4 is equally spread throughout the basin (Figure 8). There are 123 assessed river miles and 1,132 unassessed river miles in the basin. Of the assessed river miles, 39.8% are in fair geomorphic condition, 51.8% are in good condition, 7.4% are in poor condition, and 1% are in reference condition. Between 2006 and 2011 the seven Phase 2 SGAs completed in the basin included: the East Creek, the Hubbardton River, the Castleton River, the Mettowee River, the Poultney River, Lewis Brook and Finel Hollow Brook, and Vail Brook. Figure 8 also shows the geomorphic condition for those streams with completed Phase 2 SGAs.

While the majority of the assessed river segments in Basin 2 & 4 are in fair to good condition, historic straightening, clearing for agriculture, residential development, and gullies have contributed to degraded habitat conditions on Lewis Brook and poor geomorphic conditions on two segments of the Poultney River. These areas (along with the segments in fair condition) are prioritized for restoration. Final SGAs and River Corridor Plans (RCPs) for rivers in Basin 2 & 4 can be accessed at the SGA – Final Reports website.

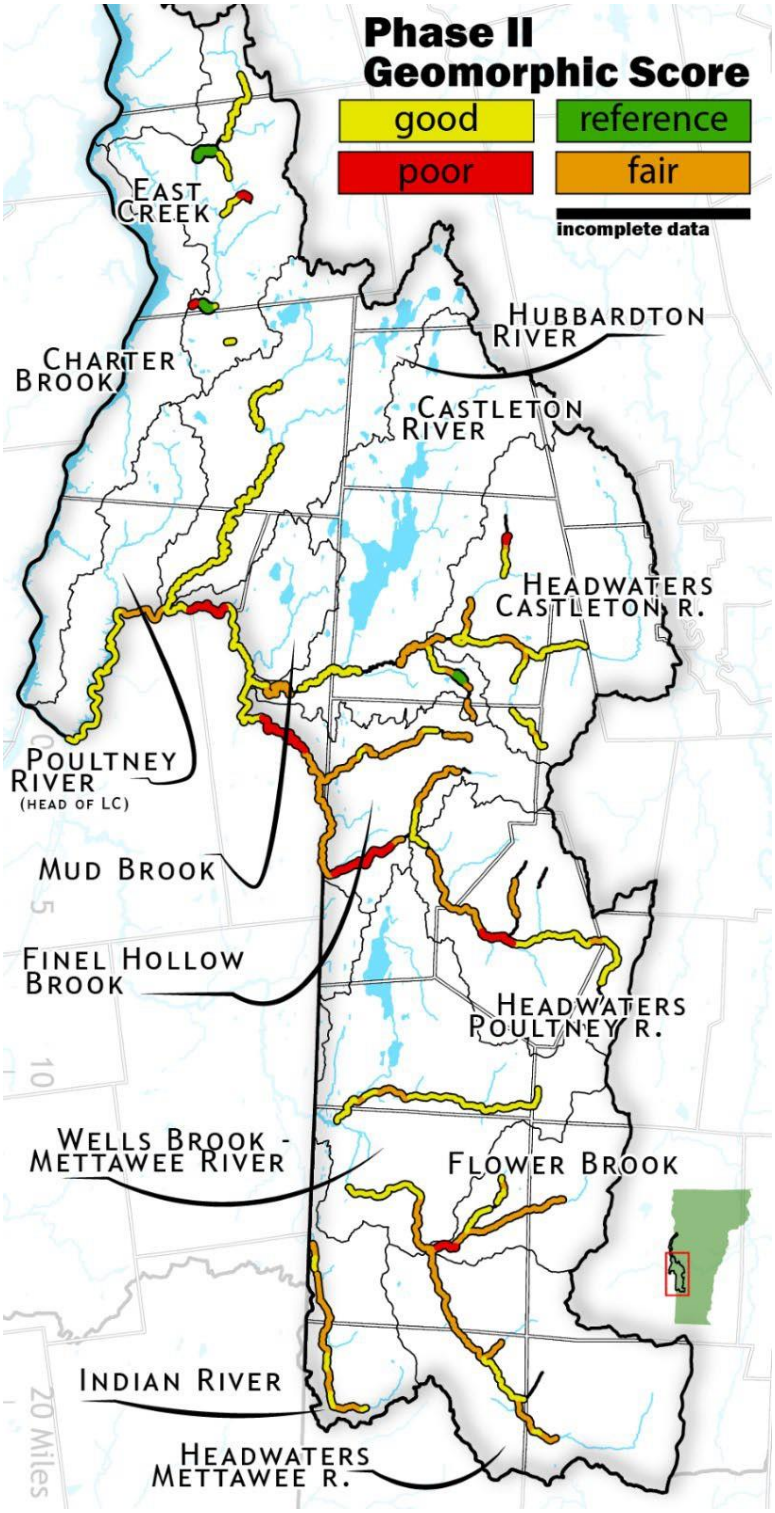


Figure 8. Geomorphic condition of streams with Phase II stream geomorphic assessments. Reference=green, good=orange, fair=yellow, poor=red. Two areas are in poor geomorphic condition, while most are in fair condition. Very few segments attain reference condition.

Condition of Lakes and Ponds

There are 36 lakes and ponds in Basin 2 & 4 that are ten acres or greater. Twenty-eight of the 36 lakes are 20 acres or larger. The three largest lakes in order from largest to smallest are Lake Bomoseen (2415.1 acres), Lake St. Catherine (885.4 acres), and Lake Hortonia (500.9 acres). Lakes that are ten acres or greater should be managed in accordance with the Vermont Hydrology Policy and meet the Hydrology Criteria (§29A-304) in the 2017 VWQS to ensure full support of designated uses.

Lake Scorecard Assessment

Lakes in Vermont are scored on the VT Inland Lakes Scorecard (Figure 9, Table 3), which is a user-friendly interface developed by the Vermont Lakes and Ponds Management and Protection Program (VLPP). The VT Inland Lakes Scorecard provides available data on overall lake health by providing a rating of a waterbody's nutrient trend, shoreland and lake habitat, atmospheric pollution, and aquatic invasive species. Lake-specific water quality and chemistry data can be accessed online through the VT Lay Monitoring Program webpage.

Of the 31 lakes evaluated for shoreland condition in Basin 2 & 4, nine have good ratings, three have poor ratings (i.e., Lake Bomoseen, Lake St. Catherine, and Burr Pond), and 19 waterbodies received a fair score. Of the 22 lakes monitored for water quality trends, no lakes have a poor rating, while Lake Bomoseen, Lake St. Catherine, Austin Pond, Beebe Pond, Lake Hortonia, Sunrise Lake, and Hinkum Pond are scored as fair. The summer phosphorus levels are significantly increasing in Lake Bomoseen, and spring phosphorus levels are significantly increasing in Lake Hortonia, Austin Pond, and Hinkum Pond.

There are three main airborne pollution types that affect lakes and ponds in Vermont: sulfur oxides, nitrogen oxides, and mercury. Mercury contamination, largely attributable to airborne deposition from sources outside Vermont, has resulted in safe eating guidelines for fish in nearly every lake in Vermont and those of nearby states as well, so all lakes in Basin 2 & 4 get a fair condition score for mercury (Figure 9, Table 3).

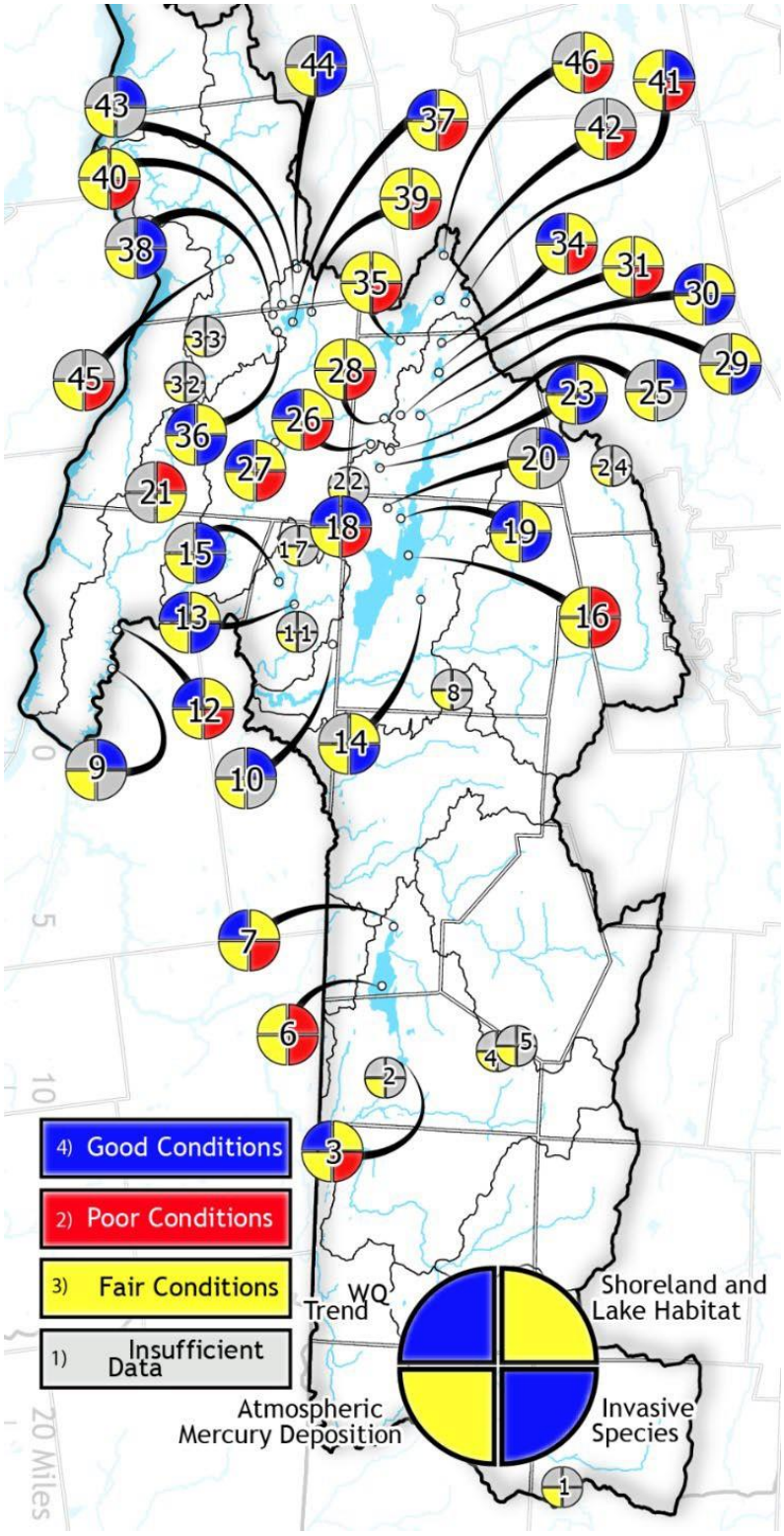


Figure 9. Map of Vermont inland lake scorecard ratings showing condition of lakes and ponds of Basin 2 & 4. Table 3 provides a key to the numbers that correspond to lakes with more than one rating.

Table 3. Lakes corresponding with Figure 9 showing lake scorecard ratings.

Map #	Lake	Shoreland Condition	AIS	Mercury	Water Quality Status
1	PRENTISS	Insufficient Data	Insufficient Data	Fair	Insufficient Data
2	N.E. DEVELOPERS	Insufficient Data	Insufficient Data	Fair	Insufficient Data
3	LITTLE (WELLS)	Fair	Poor	Fair	Good
4	FAN	Insufficient Data	Insufficient Data	Fair	Insufficient Data
5	PINNACLE	Insufficient Data	Insufficient Data	Fair	Insufficient Data
6	ST. CATHERINE	Poor	Poor	Fair	Fair
7	LILY (POULTY)	Fair	Poor	Fair	Good
8	QUARRY	Insufficient Data	Insufficient Data	Fair	Insufficient Data
9	BILLINGS MARSH	Good	Insufficient Data	Fair	Insufficient Data
10	FAIR HAVEN-W	Good	Insufficient Data	Fair	Insufficient Data
11	SCOTCH	Insufficient Data	Insufficient Data	Fair	Insufficient Data
12	COGGMAN	Fair	Poor	Fair	Good
13	OLD MARSH	Fair	Good	Fair	Good
14	PINE	Fair	Good	Fair	Insufficient Data
15	INMAN	Good	Good	Fair	Insufficient Data
16	BOMOSEEN	Poor	Poor	Fair	Fair
17	SHELDON	Insufficient Data	Insufficient Data	Fair	Insufficient Data
18	GLEN	Good	Poor	Fair	Good
19	LOVES MARSH	Fair	Good	Fair	Good
20	LILY (CASLTN)	Good	Insufficient Data	Fair	Insufficient Data
21	ROOT	Insufficient Data	Poor	Fair	Insufficient Data
22	MOSCOW	Insufficient Data	Insufficient Data	Fair	Insufficient Data
23	HALF MOON	Fair	Good	Fair	Good
24	BUTLER	Insufficient Data	Insufficient Data	Fair	Insufficient Data
25	HIGH (HUBDTN)	Insufficient Data	Good	Fair	Insufficient Data
26	BLACK (HUBDTN)	Fair	Poor	Fair	Good
27	MILL (BENSON)	Fair	Poor	Fair	Good
28	BREESE	Fair	Good	Fair	Insufficient Data
29	AUSTIN	Fair	Poor	Fair	Fair
30	ROACH	Fair	Good	Fair	Good
31	BEEBE (HUBDTN)	Fair	Poor	Fair	Fair
32	BULLHEAD (BENSON)	Insufficient Data	Insufficient Data	Fair	Insufficient Data
33	MUD (BENSON)	Insufficient Data	Insufficient Data	Fair	Insufficient Data
34	ECHO (HUBDTN)	Fair	Poor	Fair	Good
35	HORTONIA	Fair	Poor	Fair	Fair
36	PERCH (BENSON)	Fair	Good	Fair	Good
37	SUNSET (BENSON)	Fair	Poor	Fair	Good
38	DOUGHTY	Good	Good	Fair	Insufficient Data
39	SUNRISE	Fair	Poor	Fair	Fair
40	SPRUCE (ORWELL)	Good	Poor	Fair	Good
41	HINKUM	Good	Poor	Fair	Fair
42	BURR (SUDBRY)	Poor	Poor	Fair	Good
43	MUD (ORWELL)	Good	Insufficient Data	Fair	Insufficient Data
44	CHOATE	Insufficient Data	Good	Fair	Insufficient Data

45	BROOKSIDE	Insufficient Data	Poor	Fair	Insufficient Data
46	HOUGH	Fair	Poor	Fair	Insufficient Data

Twenty lakes out of the 31 that have been surveyed for aquatic invasive species (AIS) have poor scores. A poor score indicates that there is at least one invasive species present, regardless of its abundance or 'nuisance' level. The Lake Scorecard scoring process is described in 'How Lakes Are Scored' and a recorded webinar on the VDEC Watershed Management Division YouTube channel.

Lake Champlain

Unlike other lakes in the basin, Lake Champlain is not located within the boundaries of the South Lake Basin but instead receives water from the rivers of the South Lake Basin, which is part of the Lake Champlain watershed. In 2021, the Lake Champlain Basin Program released the 3-year Lake Champlain State of the Lake and Ecosystem Indicators Report. The report describes several ongoing needs and challenges:

- High flows transport most of the nutrients and sediment to the Lake and as a result, phosphorus loading is driven by annual differences in precipitation, snowpack, and drought. Annual variability in loading is likely to continue and may increase as climate changes alters precipitation patterns. The amount of phosphorus delivered to the Lake from Basin 2 & 4 each year must be reduced to implement the Lake Champlain P TMDL (see Section B in Chapter 3).
- Warm weather cyanobacteria blooms continue to impact recreation in many parts of the Lake leading to beach closures.
- Despite several invasive species interceptions and prevention measures, the fishhook water flea was discovered in the Lake in 2018.
- The COVID-19 pandemic limited public engagement in 2020. As a result, many outreach and interpretation programs were postponed or transitioned to virtual platforms (Lake Champlain Basin Program, 2021).

The report also asserts that the South Lake segment of Lake Champlain has predominantly fair status scores, except for a poor status score for "invasive water chestnut coverage". However, mechanical harvesting over the past two decades has reduced water chestnut populations in the South Lake segment and the trend is improving. The South Lake status for "phosphorus from Wastewater Treatment Facilities" is good (highest score) with an improving trend.

Condition of Wetlands

The Vermont Wetlands Program uses its Bioassessment Project to gather data about the health of Vermont wetlands. Based on a 2017 analysis of bioassessment data, the principal factors that correlate with poor wetland condition are:

- presence of invasive species,
- disturbance to the wetland buffer or surrounding area,
- disturbance to wetland soils, and

- disturbance to wetland hydrology (how water moves through a wetland) through ditching (e.g., agricultural), filling (e.g., roads) and draining (e.g., culverts).

Wetlands in remote areas and at high elevations tend to be in good condition, with the most threatened wetlands occurring in areas of high development pressure and exhibiting habitat loss.

Wetland Bioassessment and Vermont Rapid Assessment Method

The VT Wetlands Bioassessment Project calculates the Coefficient of Conservation (CoC) at each assessed wetland. The CoC is a metric that uses the presence and abundance of plant species to evaluate wetland status. Plant species are identified either within a defined plot or within a single natural community type. Each plant has a designated score to indicate its tolerance of disturbance. These scores are averaged to determine the overall balance of disturbance-tolerant species in the wetland which can offer information on the level of disturbance in the wetland. CoC scores have been calculated from 13 Level 3 plots with an average score of 3.65, a lower-than-average score for Vermont wetlands. However, the wetlands surveyed may not be representative of the basin.

The State of Vermont also uses the Vermont Rapid Assessment Method (VRAM) to rapidly assess both wetland condition and function (Tier I Assessment). Scores can range from 4 to 100. A total of 48 VRAMs were completed since 2017 in Basin 2 & 4 (Figure 10, Table 4). While these are not evenly distributed through the basin, they do include assessments at several wetland types at varying elevations. Scores ranged from 28 to 91 with a mean of 72.90, which is higher than the state average of 72.31. These assessments cannot be directly used to infer wetland condition in this watershed. Wetlands with high scores tend to be higher in the watershed and often include softwood swamp and/or peatland. Wetlands which scored lower include wetlands in the Champlain Valley, those associated with hayfields and agriculture, shrub swamps, and wetlands where the surrounding landscape has been significantly altered by human activity.

Interested organizations and citizens can help build the dataset of wetlands in Basin 2 & 4 by conducting VRAM analysis. Individuals or groups interested in learning the VRAM protocol should contact the Wetlands Program Staff for further information.

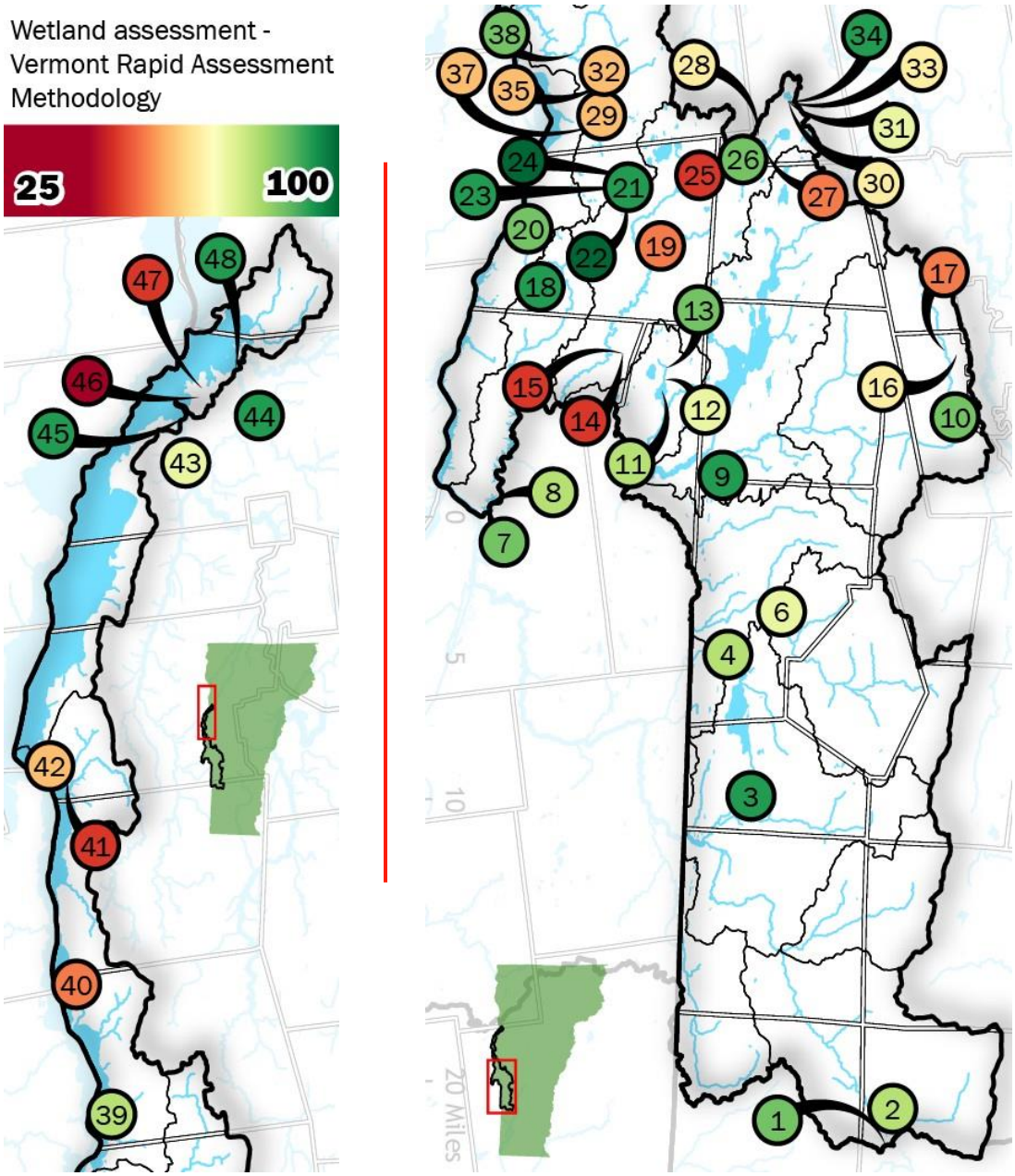


Figure 10. Wetland locations in Basin 2 & 4 with completed Tier I assessments using the Vermont Rapid Assessment Method. The scoring gradation indicates wetlands in poor (red) to excellent (green) condition. Table 4 provides a key to the numbers that correspond with VRAM wetlands.

Table 4. VRAM scores across Basin 2 & 4. Map ID corresponds to the map above. ND = No Data.

Map ID	Latitude	Longitude	Wetland	VRAM	Year
1	43.24756	-73.103	Dorset Marsh Seepage Swamp	82	2018
2	43.26575	-73.101	MERI01	78	2011
3	43.4257	-73.2035	Little Lake Wetland	83	ND
4	43.49821	-73.2208	BUMA01	77	2011
5	43.50414	-73.2161	FRBW01	-1	2015
6	43.52044	-73.1828	Poultney Floodplain	71	2019
7	43.5748	-73.392	Ward Marsh	80	2018
8	43.5748	-73.392	Ward Marsh 2019	77	2019
9	43.59716	-73.2274	Blissville Swamp	85	2020
10	43.62102	-73.06	West Rutland Marsh - Central	79	2019
11	43.63333	-73.2685	Old Marsh Pond S	76	2017
12	43.64229	-73.2681	Old Marsh Pond N	73	2017
13	43.64456	-73.2673	OLMA01	81	2008
14	43.6507	-73.3017	Hubbardton Meadows	31	2018
15	43.6511	-73.2992	Hubbardton Cattail Swale	29	2018
16	43.65551	-73.0666	Roche Floodplain Forest	61	2018
17	43.65553	-73.0702	Roche Restoration Site	39	2018
18	43.68612	-73.3574	Shaw Marsh	85	2019
19	43.70767	-73.2715	Breese Pond Outlet Wetland	38	2019
20	43.7158	-73.3663	Benson Direct Wetland	81	2019
21	43.7377	-73.2951	Pond Woods Cinnamon Fern Swamp	83	2021
22	43.74298	-73.2957	EACR01 Revisit	91	2019
23	43.74299	-73.2954	EACR01	86	2010
24	43.74364	-73.2848	Walker Swamp	91	2019
25	43.74413	-73.244	Binding Site Wetland	30	2019
26	43.75245	-73.213	Hortonia West Access Cove	81	2018
27	43.7572	-73.1952	Hortonia Route 30 Bay	46	2018
28	43.76317	-73.2019	Hortonia NE Bay	61	2018
29	43.77435	-73.3145	East Creek NWCA Site	51	2021
30	43.78436	-73.177	Huff Pond Seepage Swamp	66	2019
31	43.78777	-73.1785	Huff Pond Seep 2	72	2019
32	43.78779	-73.315	East Creek WMA Upper Dam	58	2019
33	43.78918	-73.1782	Huff Pond Seep 1	64	2019
34	43.79088	-73.1762	Huff Pond Drowned Swamp	86	2019
35	43.79112	-73.3139	East Creek Below Dam	56	2019

36	43.79806	-73.2892	SABR01	-1	2015
37	43.80155	-73.3169	Lower East Creek Dam	56	2019
38	43.80599	-73.3348	East Creek Floodplain Forest	81	2019
39	43.86062	-73.365	Maguire Hands Cove Floodplain Forest	76	2019
40	43.92717	-73.3912	Fifield Floodplain Forest	44	2019
41	44.03235	-73.3985	Hospital Creek Disturbed Clayplain	31	2019
42	44.03911	-73.412	NA	58	2019
43	44.19546	-73.3166	Otter Creek Complex	71	ND
44	44.22008	-73.2639	Little Otter Creek	84	ND
45	44.22524	-73.3118	Porter Bay Wetland	84	2019
46	44.23305	-73.3091	Grosse Point Swale	18	2021
47	44.23342	-73.3076	Grosse Point Hayfield	28	2021
48	44.24449	-73.281	Lewis Creek Delta	83	2019

Condition of Fisheries

Fisheries Monitoring

The VFWD completed 20 monitoring events on 9 rivers in Basin 2 between 2012 and 2022. Of the 20 sites in Basin 2, 11 met the criteria for B(1) Fishing:

- Criterion A: A minimum of two surveys in the last 20 years with the most recent within the last 10 years, and where trout population is >1000 trout/mile, or 200 trout >6"/mile, and/or 20 lbs./acre). Three sites on the Mettowee River met this criterion.

- Criterion B: More than two surveys in the last 10 years where 50% of surveys have trout population >1000 trout/mile, or 200 trout >6"/mile, and/or 20 lbs./acre). Three sites on the Mettowee River met this criterion.

- Criterion C: Only 1 survey in the last 10 years where total trout population is >3000 trout/mile, or 400 trout >6"/mile, and/or 40 lbs./acre). Five sites (i.e., Dayton Brook, Drew's Crick, Flower Brook, Hagar Brook, South Brook) met this criterion.

The highest total trout per mile estimate was 1,845 per mile in the Mettowee River in Pawlet. The highest estimate of trout over 6-inches was in the Mettowee headwaters in Dorset Hollow at 924 per mile.

It is expected that more rivers in Basin 2 would qualify for B(1) fishing if the frequency of sampling was increased. No stream surveys were conducted in Basin 4, as the low gradient, warmwater streams in the Champlain Valley do not provide the conditions and habitat needed to support trout populations.

Chapter 2 – Priority Areas for Surface Water Protection

The state protects lakes, wetlands, and rivers by establishing and supporting surface water management goals. Tactical Basin Plans identify surface waters that consistently attain a higher level of quality and value based on their ability to meet certain physical, chemical, and biological criteria. These waters are prioritized for reclassification or designation. This allows for the establishment of enhanced management objectives and supports implementation of strategies to protect these surface waters.

Land stewardship programs, local protection efforts, conservation easements, and land acquisition, are also used to increase protection of priority waters. These are described in Chapter 4 - Strategies for Protection and Restoration. One lake and three streams in this basin have been prioritized for reclassification because they meet standards for very high-quality condition (Figure 11, Table 6).

A. Surface Water Classification

Vermont's surface water classification system establishes management goals and supporting criteria for designated uses in four classes of water (Table 5). Designated uses include aquatic biota and wildlife, aquatic habitat, aesthetics, fishing, boating, swimming, public water supply, and irrigation. The VWQS begin classification with two broad groups based on elevation:

- All waters above 2,500 feet in elevation, are designated Class A(1) for all uses, unless specifically designated Class A(2) for use as a public water source.

- All waters at or below 2,500 feet in elevation, are designated Class B(2) for all uses, unless specifically designated as Class A(1), A(2), or B(1) for any one or more uses.

Surface waters that are classified as A(1), A(2), or B(2) for specific designated uses are published in Appendix F of the VWQS. Reclassification candidates are identified through the tactical basin planning process or on a case-by-case basis. Some surface waters currently classified as B(2) may meet or exceed the criteria for a higher classification such as B(1) or A(1) for one or more designated uses. Additional waters suitable for reclassification may be identified in the future as some waters have not been monitored. Table 5 lists the possible classes into which each use may be placed.

Table 5. Four designated uses of waters by class.

Classification (2016)	Applicable Uses
Class A(1)	One or more of: Aquatic biota and wildlife, aquatic habitat, aesthetics, fishing, boating, or swimming
Class A(2)	Public water source
Class B(1)	One or more of: Aquatic biota and wildlife, aquatic habitat, aesthetics, fishing, or boating

Class B(2)	Aquatic biota and wildlife, aquatic habitat, aesthetics, fishing, boating, swimming, public water source or irrigation

B. Surface Water Reclassification and Designation

The VWQS provide the basis for surface water protection through the Antidegradation policy (2017), the designated uses, and the minimum criteria for those designated uses that surface waters must meet. A surface water that meets or exceeds the criteria for a higher classification as established by the VWQS, a wetland that meets Class I criteria in the Vermont Wetland Rules, or a surface water that meets Outstanding Resource Water values pursuant to 10 V.S.A. §1424a may be protected through one of the following pathways:

- Lakes and Ponds Reclassification
- Stream Reclassification
- Class I Wetland designation
- Outstanding Resource Waters designation

These legal mechanisms guide ANR permitting processes to ensure that regulated activities on the landscape protect the condition of surface waters.

The tactical basin planning process includes reviewing ANR monitoring and assessment data to identify and document surface waters that exceed their current classification or designation. While ANR has the authority to move the reclassification of waters based on data, the Agency typically relies on the publication of TBPs to identify candidates for reclassification (10 V.S.A. § 1253).

Before the Agency recommends management objectives through a classification or designation action, input from the public on any proposal is required and considered. The VWQS indicate that in the basin planning process, "Public participation shall be sought to identify and inventory problems, solutions, high quality waters, existing uses and significant resources of high public interest." The public, watershed partners, and stakeholders are encouraged to make recommendations for additional monitoring and research where very high-quality waters may exist.

The VDEC enables the use of public petitions to reclassify rivers, lakes, and wetlands, and to designate Outstanding Resource Waters. VDEC has developed procedures and documents for these petitions. When the public is involved in developing proposals regarding management objectives, the increased community awareness can lead to protection of uses and values by the community and individuals.

More information on the reclassification process can be found on the following WSMD websites for lakes, streams, and wetlands.

Priority Lakes for Protection

One lake has been prioritized because it meets the standards for very high-quality condition (Figure 11, Table 6). Strategies for enhanced protection of this waterbody are described in further detail in the following sections. Surface waters in need of additional monitoring to determine their potential for reclassification or designation are included in Chapter 5 in the Monitoring and Assessment Table.

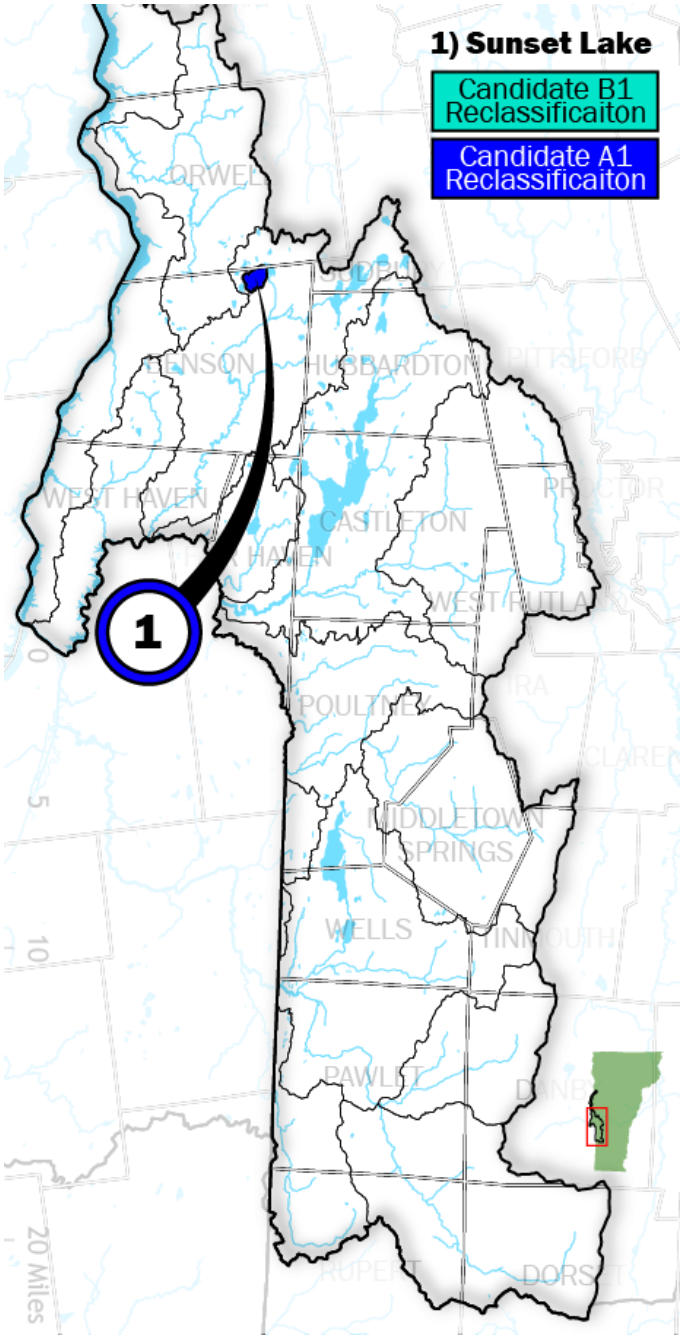


Figure 11. Map of a Basin 2 & 4 priority lake for protection. The map number corresponds with Table 6.

Table 6. Lake(s) that may meet criteria for A(1) aesthetic use.

Map #	Name	Designated Use	Class
1	Sunset Lake	Aesthetics	A(1)

A(1) & B(1) Waters for Aesthetics

The VWQS contains a designated use for aesthetic conditions, and VDEC developed numeric nutrient criteria for lakes and ponds in relation to this use (see Table 3 on page 30 in the VWQS). Sunset Lake meets the nutrient criteria for A(1) aesthetics (Figure 11, Table 6).

Priority Rivers for Protection

Three rivers have been prioritized for reclassification because they meet the B(1) criteria in the VWQS based on their biomonitoring data (Figure 12, Table 7). Strategies for enhanced protection of waters are described in further detail in the following sections. Surface waters in need of additional monitoring to determine their potential for reclassification or designation are included in Chapter 5 in the Monitoring and Assessment Table.

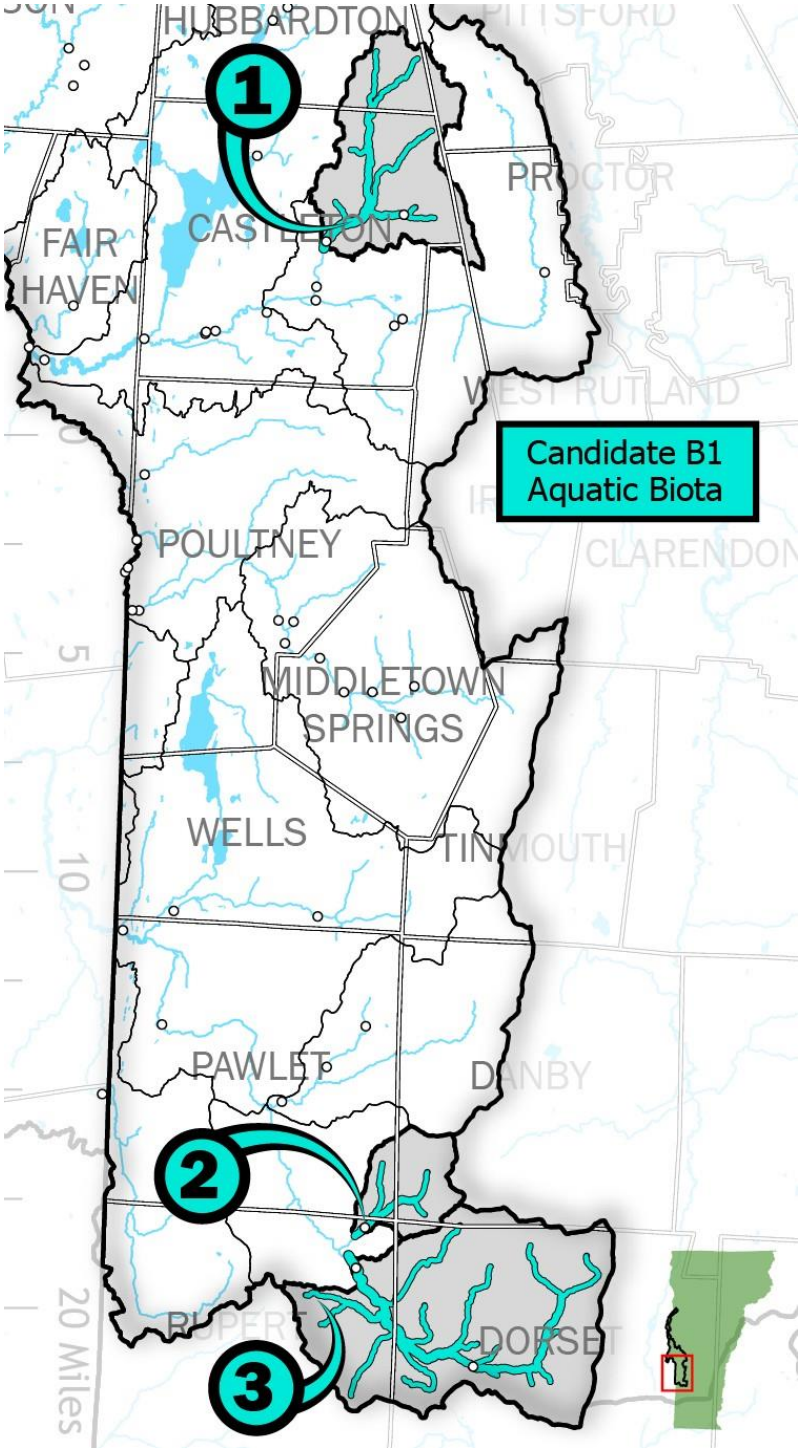


Figure 12. Map of Basin 2 & 4 priority rivers for protection. Map numbers correspond with Table 7.

Table 7. Rivers that may meet criteria for B(1) aquatic biota use.

Map #	Name	Designated Use	Class
1	North Breton Brook	Aquatic Biota	B(1)
2	Sykes Hollow Brook	Aquatic Biota	B(1)
3	Mettowee River	Aquatic Biota	B(1)

A(1) & B(1) Waters for Aquatic Biota

Based on biomonitoring assessments conducted by the WSMD, three surface waters in Basin 2 & 4, North Breton Brook, Sykes Hollow Brook, and the Mettowee River consistently and demonstrably attains a higher level of quality than Class B(2) and may meet Class B(1) criteria for aquatic biota (Figure 12, Table 7).

A(2) Public Water Sources

Four waters are designated as A(2) public water sources in Basin 2 & 4 (Table 8). Inman Pond is a water source for the village of Fair Haven and is actively being used. Three others are no longer being used as public water sources and could be reclassified to reflect their current condition for the designated uses.

Table 8. Class A(2) designated public water sources in the Basin 2 & 4.

Waters	Water Source	Description
Inman Pond	Benson, Fair Haven	**Permanent.** Village of Fair Haven (WSID 5218) water source. Inman Pond and all waters within its watershed in Fair Haven.
Sucker Creek (Sheldon Dam)	Fair Haven	**Abandoned**. Village of Fair Haven water source. Sucker Creek and all waters within its watershed upstream of Sheldon Dam, located in Fair Haven.
Sucker Creek (Howard Dam)	Fair Haven	**Abandoned**. Village of Fair Haven water source. Sucker Creek and all waters within its watershed upstream of Howard Dam, located in Fair Haven.
Young's Brook	Ira, West Rutland	**Abandoned.** Village of West Rutland water source. Young's Brook and reservoir and all waters within its watershed in West Rutland and Ira upstream of the water intake.

B(1) Waters for Recreational Fishing

Certain waters in Basin 2 & 4 support productive populations of cold-water salmonids. Rivers and streams classified as B(1) recreational fishing waters support wild, self-sustaining salmonid populations characterized by the presence of multiple age classes and a minimum abundance of 1,000 individuals per mile (all species/ages/sizes); and/or 200 large (> 6 inches total length) individuals per mile; and/or 20 pounds/acre (all species/ages/sizes). The 11 streams that meet B(1) criteria for recreational fishing (§29A-306 of the VWQS) are Dayton Brook, Drew's Crick, Flower Brook, Hagar Brook, South Brook, and six sites on the Mettowee River .

These waters shall be managed to achieve and maintain the documented quality of fishing. The 11 waters identified may be adjusted in the future based on new and updated surveys and as protocols are refined. Waters that meet the criteria in the VWQS for both B(1) and A(1) fishing use will be continually identified and updated. It is important to note that all waterbodies that would naturally support fish populations are protected and maintained in perpetuity.

Class I Wetland Designation

It is policy of the State of Vermont to identify and protect significant wetlands and the values and functions they serve in such a manner that the goal of no net loss of such wetlands and their functions is achieved. Based on an evaluation of the extent to which a wetland provides functions and values, it is classified at one of three levels:

- **Class I**: Exceptional or irreplaceable in its contribution to Vermont's natural heritage and therefore, merits the highest level of protection.
- **Class II**: Merits protection, either taken alone or in conjunction with other wetlands.
- **Class III**: Neither a Class II nor a Class I wetland.

Impacts to Class I wetlands may only be permitted when the activity is necessary to meet a compelling public need for health or safety. The VT Wetlands Program has created a Class I website with an interactive map. This website includes the determinations for nine Class I wetlands including six wetlands that were added since 2016.

In 2022, Ward Marsh was petitioned as a Class I Wetland by the Town of West Haven with support from the Rutland Regional Planning Commission, because of the exceptional and irreplaceable functions it provides on the landscape. It is expected to be adopted as a Class I Wetland in early 2023. The Wetlands Program has identified the wetlands north of Ward Marsh along the Poultney River for further study as having the potential for Class I designation. No additional wetland candidates have been proposed by the Vermont Wetlands Program in the Basin 2 & 4. One wetland, the South Fork of East Creek in Benson and Orwell, has been identified for further study for Class I wetland designation. These wetlands are described in Chapter 4.

VDEC supports the further study and petitioning of these wetlands and the VT Wetlands Program welcomes recommendations for Class I candidates. Those wetlands that satisfy criteria for designation may be proposed for such designation through departmental rulemaking authority, and as consistent with the Vermont Wetland Rules.

Outstanding Resource Waters Designation

Vermont Act 67 ("An Act Relating to Establishing a Comprehensive State Rivers Policy," 1987) provides protection to rivers and streams that have "exceptional natural, cultural, recreational, or scenic values" through the designation of Outstanding Resource Waters (ORW). Other waters may also be designated as ORWs. The VWQS Antidegradation Policy requires that ORW's existing quality, associated with the values for which an ORW was designated, be protected, and maintained. Waters can be proposed for ORW designation by the ANR through rulemaking.

The lower Poultney River has been designated as an ORW for natural, cultural, and scenic values. At the present time there are no other ORW designations in the basin or candidates that were brought forth during the planning process for this basin plan. Although no other waters have been identified as ORW candidates in this plan, there may be waters in the basin which merit this designation and for which ORW status should be pursued.

The Agency will support collaborative efforts to develop the materials, and to conduct outreach necessary to support rulemaking for ORW designation of waters, should there be public interest. On receipt of a signed written request, the Secretary shall consider the adoption, amendment, or repeal of rules regarding ORW designation and shall take appropriate action as required under 3 V.S.A. § 806. After consideration of all relevant information, the Secretary shall determine whether to enter rulemaking to designate the waters as ORW if it finds that they have exceptional natural, recreational, cultural, or scenic values. (10 V.S.A. § 1424a).

C. Identification of Existing Uses

The ANR may identify existing uses of waters during the tactical basin planning process or on a case-by-case basis during application reviews for State or Federal permits. Consistent with the federal Clean Water Act, the VWQS stipulate those existing uses may be documented in any surface water location where that use has occurred since November 28, 1975. Existing uses are a confirmation of the set of designated uses in the VWQS regardless of the classification of the water.

The ANR stipulates that all lakes and ponds in the basin have existing uses of swimming, boating, and fishing. The ANR recognizes that fishing activities in streams and rivers are widespread and too numerous to thoroughly document for Basin 2 & 4. In the case of streams too small to support significant fishing activity, the ANR recognizes these as potential spawning and nursery areas, which contribute fish stocks downstream where fishing may occur. These small streams support the use of fishing and therefore, are protected at a level commensurate with downstream areas.

Existing uses in Basin 2 & 4 should be viewed as a partial accounting of known existing uses based on limited information. The list does not change protection under the Clean Water Act or VWQS for unlisted waters. The existing uses in the basin of swimming, boating, fishing, and public water source are found in Appendix A of the 2017 Basin 2 & 4 TBP. The public is encouraged to recommend waters for the existing uses of swimming, boating, fishing, public water source, and ecological significance given that they provide evidence of such use. For existing uses of waters, the level of water quality necessary to protect those existing uses shall be maintained and protected regardless of the water's classification (VDEC, 2017).

Chapter 3 – Priority Areas for Surface Water Restoration

A. Impaired Surface Waters

The VDEC monitors and assesses the chemical, physical, and biological status of individual surface waters to determine if they meet the VWQS per the 2022 Vermont Surface Water Assessment and Listing Methodology (Vermont Department of Environmental Conservation, 2022). Surface waters are assessed as: full support, altered, or impaired. To address Section 303(d) of the Federal Clean Water Act, the VDEC develops the 303(d) List of Impaired Waters, which includes impaired lakes, ponds, rivers, and streams that do not meet VWQS. The 303(d) List of Impaired Waters is included as part of the Priority Waters List, Part A.

Other parts of the Priority Waters List identify waters that do not meet water quality standards, but do not require a TMDL as other pollution control mechanisms are in place (Part B), a TMDL is already in place (Part D), the cause of the impairment is not a pollutant, such as Aquatic Invasive Species (AIS) (Part E) or flow modifications (Part F). These lists can be viewed on the DEC Assessment and Listing webpage. For a more detailed description of monitoring results use the Vermont Integrated Watershed Information System (IWIS) online data portal.

A primary purpose of the plan is to identify the source of pollutants degrading the waters listed in the following sections and then, address those waters with strategies in the Chapter 5 Implementation Table. The types of strategies prescribed are based on the sector-specific practices outlined in the Vermont Surface Water Management Strategy.

Priority Lakes for Restoration

Figure 13 and Table 9 show the lakes listed on Part A and/or Part D in Basin 2 & 4. The primary pollutants of concern in the impaired lakes are phosphorus and mercury in fish tissue.

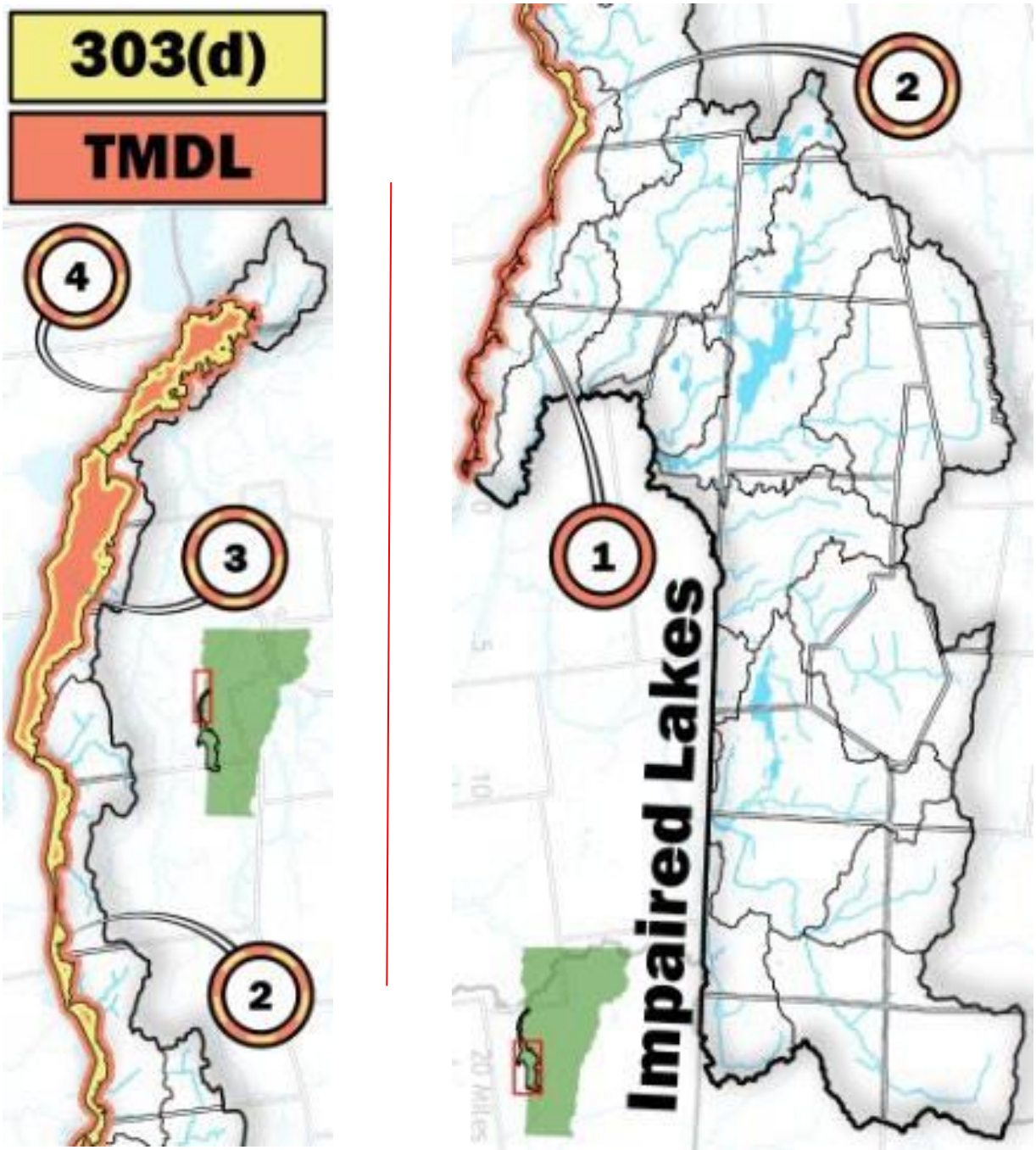


Figure 13. Two-part map of Basin 2 & 4 impaired lakes showing waters on the following lists: Part: A=303(d) and Part D=impaired with an EPA approved TMDL. The Map numbers correspond with Table 9 surface water descriptions.

Table 9. Basin 2 & 4 priority waters and pollutants. Map numbers in this table correspond with the map above.

MAP #	NAME	POLLUTANT(S)	PROBLEM	LIST
4	Lake Champlain Otter Creek segment	Phosphorus, Mercury	Phosphorus enrichment, Elevated levels of PCBs in lake trout	D, A
3	Lake Champlain Port Henry segment	Phosphorus, Mercury	Phosphorus enrichment, Elevated levels of Mercury in walleye, elevated levels of PCBs in lake trout	D, A
2	Lake Champlain South Lake A segment	Phosphorus, Mercury	Phosphorus enrichment, Elevated levels of Mercury in walleye, elevated levels of PCBs in lake trout	D, A
1	Lake Champlain South Lake B segment	Phosphorus	Phosphorus enrichment	D

Typically, lakes are listed as altered due to a lack of flow, water level fluctuation, modified hydrology arising from human activity (flow regime), or AIS (Figure 14, Table 10). Figure 14 and Table 10 show the Basin 2 & 4 lakes listed on Part E due to AIS and none are listed as flow altered. Associated with the map is a table further describing impairment or alteration. Use the upper case Lake ID to find more information in the report viewer or for more information on AIS, see the aquatic invasive webpage.

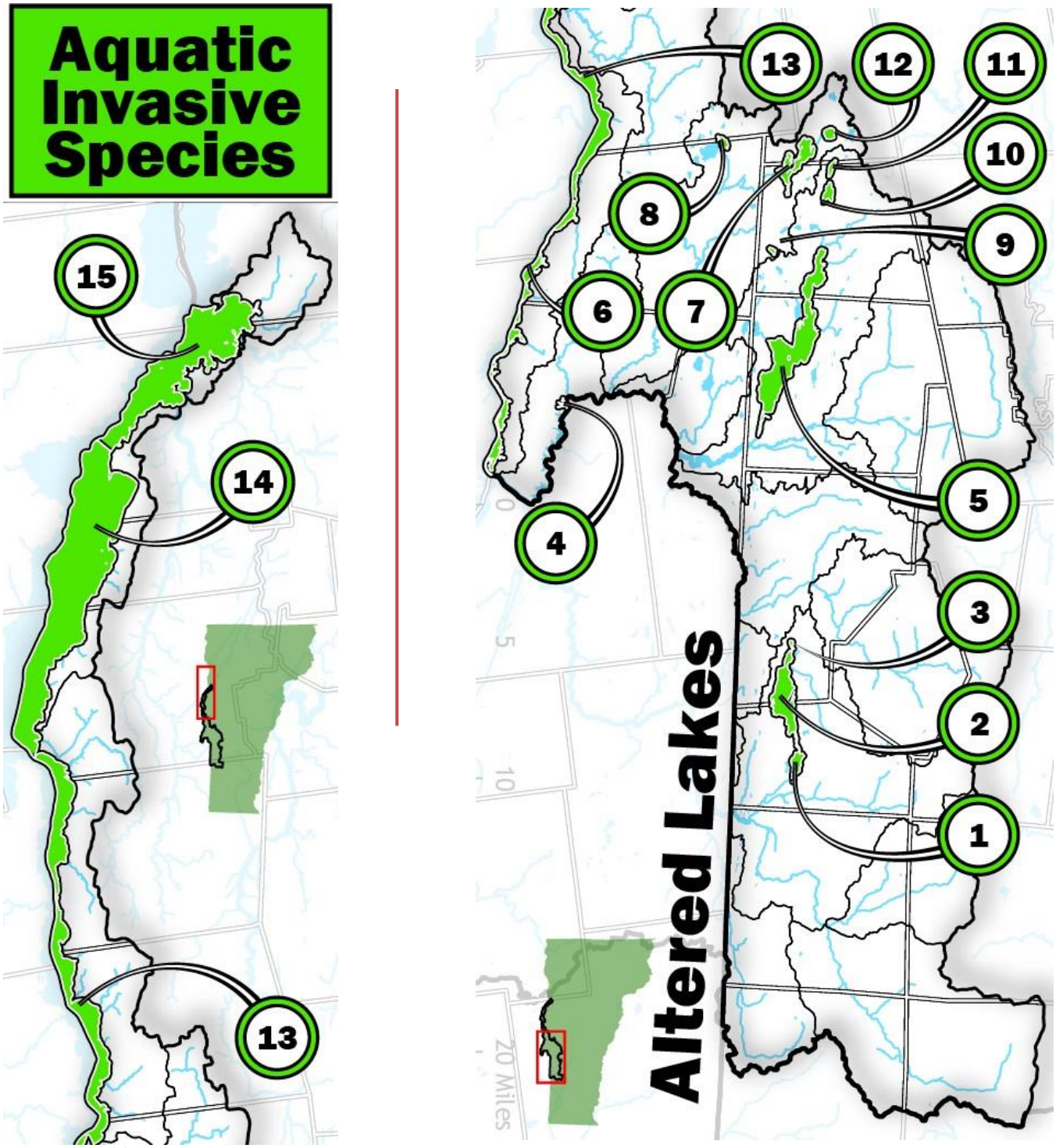


Figure 14. Two-part map of Basin 2 & 4 altered lakes showing waters on the following lists: Part: E= aquatic invasive species (AIS). The map numbers correspond with Table 10 surface water descriptions.

Table 10. List of altered lakes across Basin 2 & 4. Map numbers correspond to the map above. Part E= altered by AIS, EWM = Eurasian Watermilfoil (*Myriophyllum spicatum*), WC = Water Chestnut (*Trapa natans)*, AC = Asian Clam (*Corbicula fluminea*) , ZM = Zebra Mussel (*Dreissena polymorpha),* DASH = Diver Assisted Suction Harvesting.

Map #	Name	Problem	Pollutant	Part
1	Little (Wells)	Ongoing management plan that includes mechanical harvesting and herbicide.	EWM	E
2	St. Catherine	Ongoing management plan that includes herbicides, DASH, benthic barriers, and hand-pulling.	EWM	E
3	Lily (Poultney)	Ongoing management plan that includes herbicides, DASH, benthic barriers, and hand-pulling.	EWM	E
4	Coggman	Active hand-pulling efforts for WC.	EWM, WC	E
5	Bomoseen	Ongoing management plan that includes mechanical harvesting efforts.	EWM, ZM, AC	E
6	Southern Section (B) - Lake Champlain (Bridport)	Active hand-pulling efforts for WC.	WC	E
7	Hortonia	Ongoing management plan that includes herbicides, DASH, benthic barriers, and hand-pulling.	EWM	E
8	Sunrise	Ongoing management plan that includes DASH, benthic barriers, and hand-pulling.	EWM	E
9	Black (Hubbardton)	No active management.	EWM	E
10	Beebe (Hubbardton)	Ongoing management plan that includes herbicides, DASH, benthic barriers, and hand-pulling.	EWM	E
11	Echo (Hubbardton)	Ongoing management plan that includes DASH, benthic barriers, and hand-pulling.	EWM	E
12	Burr (Sudbury)	Ongoing management plan that includes herbicides, DASH, benthic barriers, and hand-pulling.	EWM	E
13	Southern Section - Lake Champlain (Bridport)	Active mechanical harvesting and hand-pulling efforts for WC. ZM are ubiquitous.	EWM, ZM, WC	E
14	Port Henry Section - Lake	No active management. ZM are ubiquitous.	EWM, ZM	E

	Champlain (Ferrisburgh)			
15	**Otter Creek Section - Lake Champlain (Ferrisburgh)**	**Active hand-pulling efforts for WC. ZM are ubiquitous.**	**EWM, ZM, WC**	**E**

Priority Rivers

Figure 15 and Table 11 show the rivers listed in Part A and/or Part D in Basin 2 & 4. The primary pollutants of concern in the impaired rivers are nutrients, *E. coli*, and mercury in fish tissue. Use the stream name and the first seven characters of the Assessment Unit ID to find monitoring data from the reach in this report viewer.

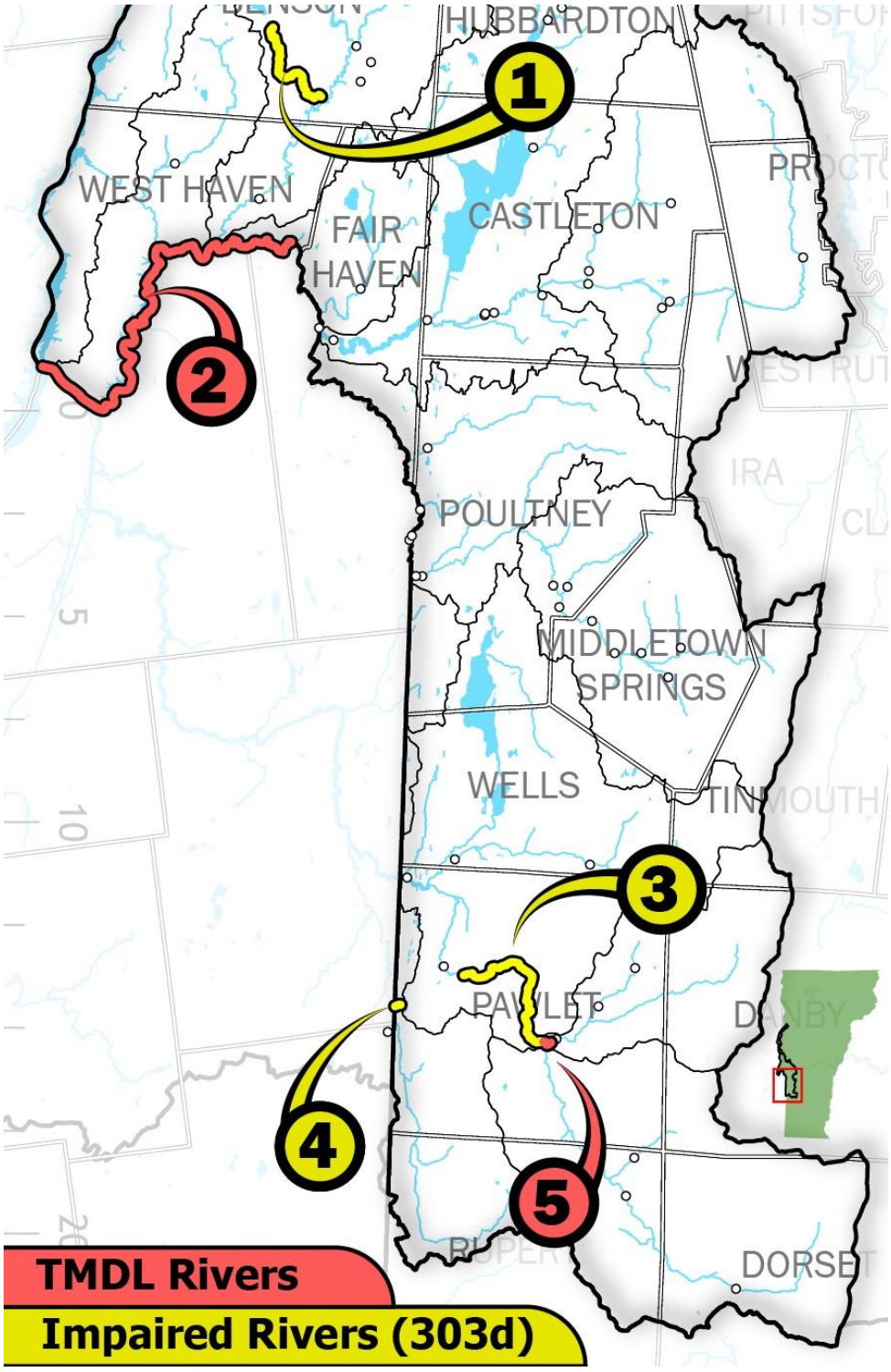


Figure 15. Map of Basin 2 & 4 impaired rivers showing waters on the following lists: Part: A=303(d) and Part D=impaired with an EPA approved TMDL. The map numbers correspond with Table 11 surface water descriptions.

Table 11. Table of impaired rivers across Basin 2 & 4. Map IDs are associated with the map above.

Map #	Name	Assessment Unit ID	Pollutant	Problem	Impaired Use	Part
1	Hubbardton River, Trib #7, Below WWTF Discharge	VT02-02.01	Nutrients	Benson WWTF, agricultural runoff, elevated chloride possible sources	ALS	A
2	Poultney River, Mouth Upstream to Hubbardton River	VT02-01.01	Mercury in fish tissue	Elevated levels of mercury in walleye	FC	D
2	Poultney River, From Hubbardton River to Carvers Falls	VT02-01.02	Mercury in fish tissue	Elevated levels of mercury in walleye	FC	D
3	Mettowee River, Flower Brook Confluence Downstream 4.3 Mi.	VT02-05.04	*Escherichia coli* (*E. coli*)	Consistently elevated *E. coli*	CR	A
4	Unnamed Trib to Indian River	VT02-05.02	Iron, Zinc	Pawlet landfill leachate, monitoring to continue to better identify source location	ALS	A
5	Flower Brook, Mouth to rm 0.5	VT-05.03	*Escherichia coli*	Consistently elevated *E. coli*	CR	D

Typically, rivers are listed as altered by flow regime. Altered flow regime includes manipulation of flow and lake levels such as lake drawdowns, snowmaking operations, hydropower facilities and water withdrawals that do not comply with the water quality standards. These alterations are identified in Figure 16 and Table 12. Use the stream name and the first seven characters of the Assessment Unit ID to find monitoring data from the reach in this report viewer.

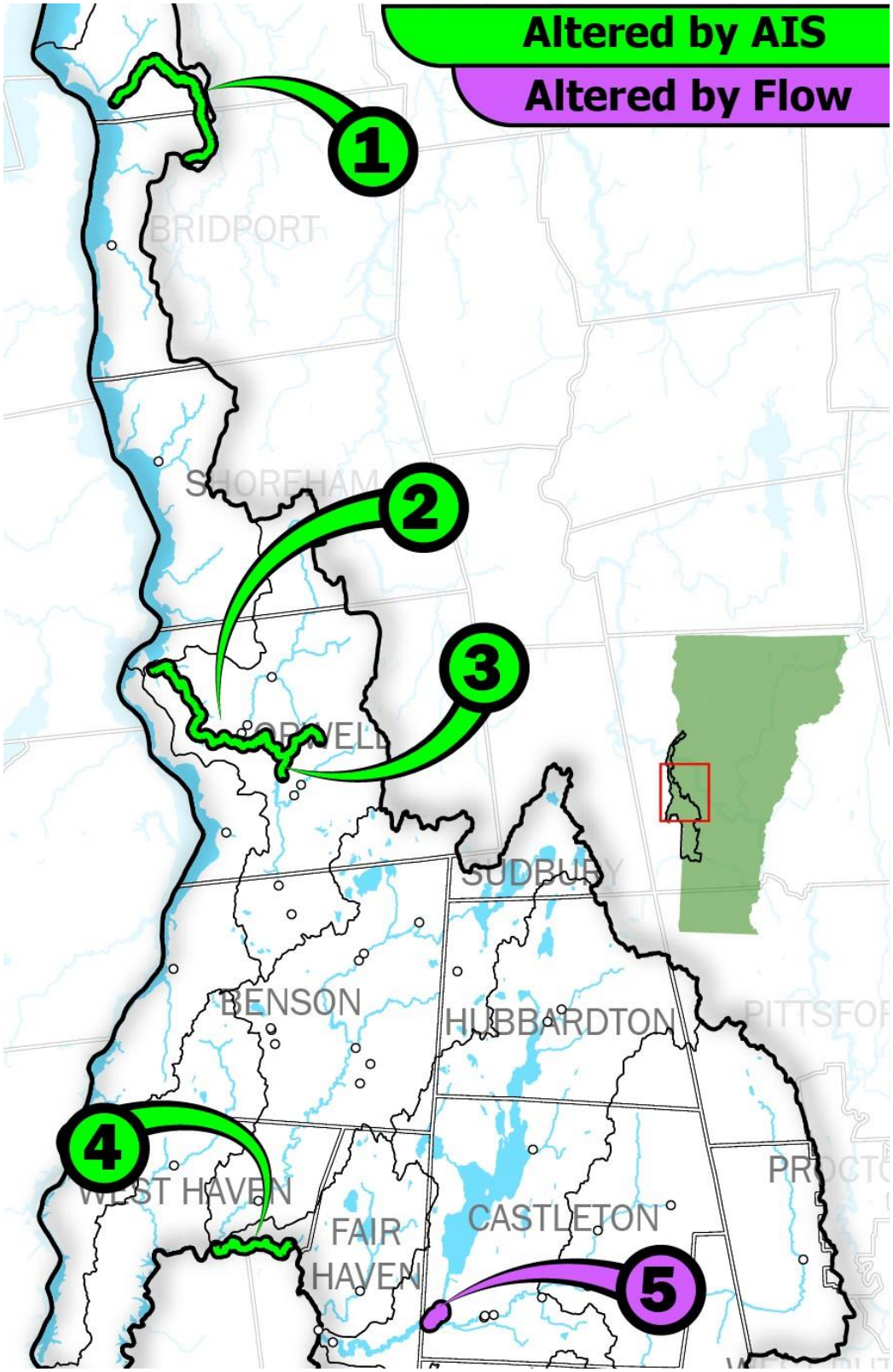


Figure 16. Map of Basin 2 & 4 altered rivers showing waters on the following lists: Part: E= AIS and Part F=flow altered. The Map numbers correspond with Table 12 surface water descriptions.

Table 12. Table of altered rivers across Basin 2 & 4. Map numbers are associated with the map above. AES = Aesthetics, ALS = Aquatic Life Support, CR = Contact Recreation, RB = Recreational Boating, ND = No Data. EWM = Eurasian Watermilfoil (*Myriophyllum spicatum*), WC = Water Chestnut (*Trapa natans).*

MAP #	NAME	ASSESSMENT UNIT ID	POLLUTANT	IMPAIRED USE	PROBLEM	PART
1	Lower Whitney Creek	VT04-02.01	EWM, WC	AES, ALS, CR, RB	Locally abundant EWM and WC growth	E
2	East Creek Segment, Orwell	VT04-03.01	WC	AES, ALS, CR, RB	Locally abundant WC growth	E
3	South Fork East Creek	VT04-03.02	WC	AES, ALS, CR, RB	Locally abundant WC growth	E
4	Poultney River, From Hubbardton River to Carver's Falls	VT02-01.02	WC	AES, ALS, CR, RB	Locally abundant WC growth	E
5	Lake Bomoseen Outlet Stream (0.4 Mi)	VT02-03.02	Water level fluctuation	ALS	Flow fluctuation and no minimum flow below the Lake Bomoseen dam used to manage water level	F

B. Basin Specific Total Maximum Daily Loads (TMDLs)

A Total Maximum Daily Load (TMDL) is the calculated maximum amount of a pollutant that a waterbody can receive and still meet VWQS. In a broader sense, a TMDL is a plan that identifies the pollutant reductions a waterbody needs to meet the VWQS and develops a means to implement those reductions. TMDLs can be calculated for reducing water pollution from specific point source discharges or for an entire watershed to determine the location and amount of needed pollution reductions. TBPs serve as the implementation plan to guide the actions necessary to meet TMDL reduction targets specific to each planning basin.

TMDLs for Basin 2 & 4 include:

- Northeast Regional Mercury TMDL,
- Lake Champlain Phosphorus TMDL, and the
- Statewide TMDL for Bacteria-Impaired Waters.

The Mercury TMDL is primarily focused on regional efforts to reduce atmospheric

deposition and so is not described in greater detail beyond the link provided above.

Lake Champlain Phosphorus TMDL

Lake Champlain is one of the largest lakes in North America and is bordered by Vermont and New York and the Province of Quebec. The 8,234 square mile watershed drains nearly half the land area of Vermont (56% of the basin), as well as portions of northeastern New York (37% of the basin) and southern Quebec (seven percent of the basin). Roughly 64% of its land area is forested, 16% is agricultural, 10% is open waters, six percent developed, and four percent is wetlands.

Lake Champlain is impaired by the nutrient phosphorus, which causes cyanobacteria blooms and unpleasant odors, and leads to low dissolved oxygen concentrations, impaired aquatic life, and reduced recreational use. Phosphorus sources to the Lake include agricultural runoff, streambank erosion, developed lands runoff (including roads, parking lots, lawns, athletic fields, buildings, and industrial facilities), wastewater treatment plant discharge, and runoff from forest harvesting operations and forest roads.

Total phosphorus concentrations vary greatly among the 12 Vermont lake segments that comprise Lake Champlain and its Vermont watersheds. The Southern Lake Champlain tactical basin drains into multiple lake segments, including Otter Creek (1,114 square miles), Port Henry (27.8 square miles), South Lake A (75 square miles), and South Lake B (388 square miles). Eutrophic conditions exist in South Lake A and B, where mean phosphorus concentrations limits are 25 and 54 µg/l, respectively. The limit is often exceeded in South Lake A Segment (Lake Champlain Basin Program (LCBP) State of the Lake Report, 2021).

The United States Environmental Protection Agency (EPA) has established Total Maximum Daily Loads (TMDL) for all twelve Vermont lake segments to ensure that phosphorus reductions are met throughout the lake. While phosphorus concentrations vary among the segments, the interconnectedness of the segments necessitates a lake-wide approach to achieving TMDL targets. The Lake Champlain segments have been included on Vermont's Impaired Waters List (Section 303(d)) list as impaired for phosphorus since the late 1990's and a revised TMDL plan was completed and approved by the EPA in 2016 to describe how the State will achieve the pollution reduction targets (United States Environmental Protection Agency, 2016). This section, along with Chapters 4 and 5, serves to inform the Accountability Framework for the TMDL's Phase 3 Implementation Plan.

Phases 1, 2, & 3 of the Lake Champlain TMDL

The EPA approved the VT Lake Champlain Phosphorus TMDL Phase 1 Implementation Plan in September 2016. The plan addressed all major sources of phosphorus to Lake Champlain and proposed efforts from all land use sectors. The Phase 1 plan included the state's policy commitments relating to regulatory changes and new programs that provide the foundation for longer-term success. Some increased efforts included enhanced regulatory oversight by state government, new requirements for municipal road and stormwater management, additional agricultural regulations, developed land stormwater management, as well as incentives for

landowners to implement water quality BMPs. The Vermont Clean Water Act created the statutory authority to implement all provisions of the Phase 1 Plan.

Phase 2 of the TMDL then provided a downscaling of phosphorus allocations to the tactical planning basin, and prioritized catchments for remediation based on highest modeled load reductions as well as a description of pollution tracking and accounting mechanisms. The Phase 2 content in the 2017 South Lake Champlain Tactical Basin Plan identified regulatory programs to address phosphorus loading and specified target areas for implementing reduction strategies from all land use sectors.

Phase 3 of the TMDL is presented in this plan and describes the progress achieved in pollutant reductions since 2017 by land use sector, projects sector specific target reductions for the next five years, reports on reduction requirements across all sectors within the South Lake Basin, including regulatory and non-regulatory actions, and identifies gaps in strategy implementation. This Phase 3 accounting fulfills requirements of the Lake Champlain TMDL Accountability Framework.

The South Lake Champlain Basin and Load Reductions

The South Lake "A," the South Lake "B," and the Port Henry segments are among the 12 TMDL segments in VT where phosphorus reductions are required to restore Lake Champlain and meet Vermont's Water Quality Standards (Figure 17). The Poultney and Mettowee Rivers drain into the South Lake "B" segment of Lake Champlain, which then flows north, combining with several smaller drainages which flow into South Lake "A" and the Port Henry segments. These drainages include East Creek (Orwell), Stoney Creek, Braisted Brook, Whitney, and Hospital Creeks in Addison County. The latter

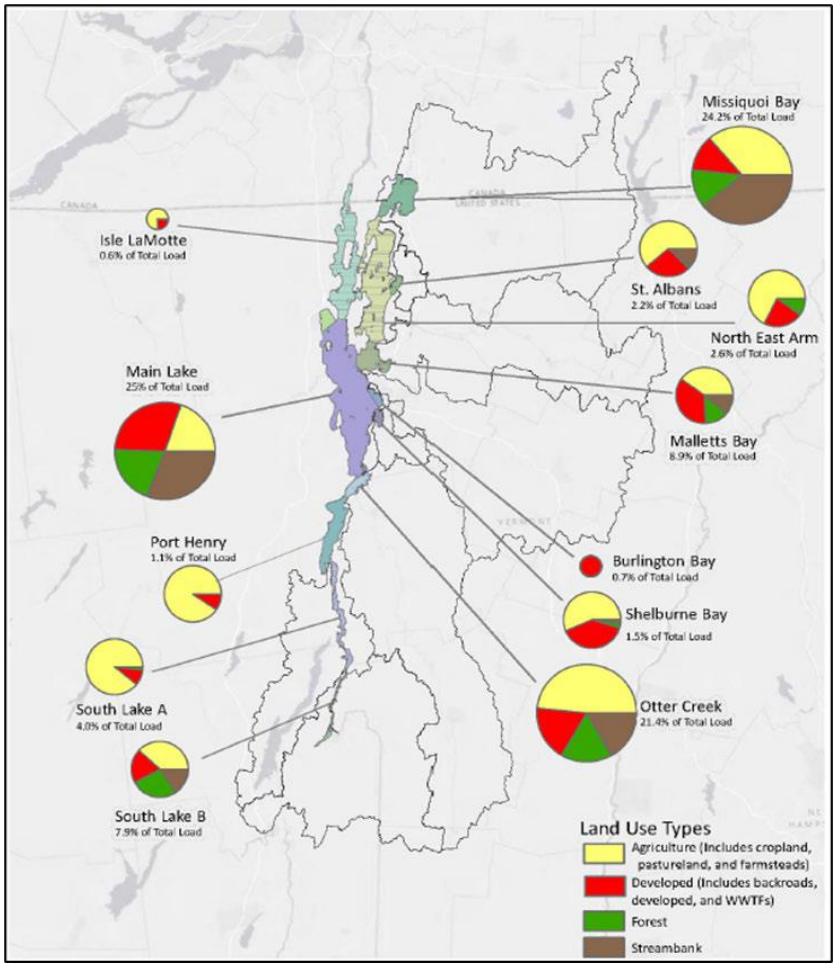


Figure 17. Vermont sources of P loading to Lake Champlain segments, by land use; annual average of 2001-2010. Source: US EPA, 2016.

drainages are part of Basin 4 or the lower Lake Champlain Direct tributaries. This plan only addresses loading from Basin 2 & 4.

On average, the Vermont portion of the South Lake receives approximately 13 percent (95,600 kg/yr.) of the total phosphorus load to Lake Champlain (Table 13) compared to the Otter Creek, which receives about 21.4 percent (141,000 kg/yr.) of the total load.
To meet the Lake Champlain Phosphorus TMDL expectations, total annual phosphorus loading into Lake Champlain from Basin 2 & 4 is required to be reduced by 51% or by approximately 49,100 kg/yr. (Table 13). Three interactive online reports are included in this Phase 3 section to further illustrate loading and reduction estimates for the TMDL relative to Basin 2 & 4 and the agricultural sector where ample tracking information allows for more detailed estimations. Each of these reports is provided below and within the text of the following sections:

1. *Estimated TMDL Total Phosphorus (TP) Loading and Reduction* online report
2. *Basin 2 & 4 Agricultural Phosphorus Loading & Reduction* online report
3. *Basin 2 & 4 Agricultural Tracking & Target Setting* online report.

Sub-watershed scale phosphorus loading and reduction estimates for HUC12 watersheds within Basin 2 & 4 can be examined and compared with other watersheds using the *Estimated TMDL TP Loading & Reduction* online report, which displays estimates for all land use sectors and HUC12 watersheds in the Lake Champlain basin. The first page of the report summarizes estimated phosphorus loading by HUC12 watershed; the second page of the report summarizes estimated phosphorus reduction targets by HUC12 watershed.

Table 13. Summary table of total phosphorus watershed annual loading, total annual reduction targets, and required reductions for Basin 2 & 4. * Fields include cultivated crops and hay.

Source	Category	Allocation category	Total Load (kg/yr.)	Total annual reduction goal (kg/yr.)	% Reduction required for basin
Agriculture	Fields*/pastures	Load	53,625	33,731	62.90%
	Barnyard Production Areas	Wasteload	2,288	1,830	79.98%
Developed Lands	**Stormwater & Roads**				
	VTrans owned roads and developed lands	Wasteload	14,812	2,999	20.25%
	Roads MRGP				
	MS4				
	Three-Acre General Permit				
Wastewater	WWTF discharges	Wasteload	700	0	0%
	CSO discharges	Wasteload	0	0	NA
Rivers	All streams	Load	10,052	4,694	46.70%
Forests	All lands	Load	14,845	5,860	39.47%
		Total	***95,623***	***49,114***	***51.0%***

Measuring Progress Towards TMDL Targets[4]

The Clean Water Initiative Program (CWIP) has developed tracking and accounting methods to measure progress on meeting the TMDL. Tracking and accounting methods are still being developed and improved as of the writing of this plan and notable progress is being made in the stormwater and agriculture sectors. CWIP also produces an annual report, the Vermont Clean Water Initiative Performance Report, that describes progress toward statewide pollution reduction goals including basin-specific progress. A final report card documenting progress on the implementation table in Chapter 5 of the TBP will be included with the 2022 Performance Report (i.e., a 5-year report card from 2017) and then in 2.5 year increments the report cards will document the progress achieved per each iteration of the plan with the next 5-year report card appearing in the 2027 Performance Report. This section of the TBP reports on the progress made in meeting the annual phosphorus reduction needed to reach the TMDL allocation for Basin 2 & 4.

[4] The 2022 TBP reports on phosphorus reductions from July 1, 2016, to June 30, 2021. The plan illustrates these reductions using the calendar year format from 2017-2021. The 2026 5-year target is SFY2026 starting on July 1, 2021, and ending on June 30, 2026.

Table 14 shows progress by sector for the past five years (2017-2021). The reductions have generally increased annually for each sector. This upward trend can be more clearly observed in Figure 18. Each year in the bar chart shows the percent of the final target (total TMDL reduction due in 2036) achieved. The totals are not cumulative, and the same volume of reduction must be achieved each year to maintain the 2036 target. Within the first five years, the agriculture sector is meeting 27.89% of the final target for fields and pastures and 34.76% of the final target for barnyard production areas and the developed lands sector is meeting 11.78% of their final target. The factors leading to the substantial increase in phosphorus load reductions in the agricultural sector in contrast to the minimal reductions seen in the other sectors may include earlier regulatory compliance dates and focused efforts by partners. In addition, the agricultural sector has established phosphorus reduction accounting methods for BMPs, whereas BMP accounting methodologies are being developed or have only recently been developed in other sectors.

See the following Forestland Sector and Wastewater Sector sections for more details on targets and progress for these sectors. The Agency expects to see increases in reductions across all sectors in Table 14 in the next five years and beyond as associated regulatory programs are implemented more comprehensively and reduction efficiency methodologies are developed and established for all clean water project types. The final section of this Phase 3 - TMDL Sector Status of Achieving Targets - provides a description of the planned improvements and progress.

Table 14. Summary table of estimated TP reductions (kg/yr.) for each sector from 2017 to 2021.

Sector	Kg of TP Reduced Annually				
	2017	2018	2019	2020	2021
Field/Pastures	3,714	2,785	4,220	8,954	9,407
Barnyard Production Areas	70	289	553	635	636
Stormwater	0	46	47	47	48
Road	10	21	40	95	121
River	33	61	74	108	112
Forest	-	-	-	-	-

Five-year phosphorus load targets for 2021-2026 for each sector as they relate to achieving the TMDL are shown in Table 15. Progress implementing strategies in this plan will be measured against the five-year TP reduction targets, which are the proposed milestones for each sector. The five-year target setting is obtained by subtracting the current-year reduction estimates for each sector from the overall TMDL sector goal and dividing into five-year segments. The 2027 South Lake Champlain Tactical Basin Plan will report progress on achieving the target milestones suggested in this plan and address challenges or gaps in achieving those targets in each subsequent phase of TMDL implementation, each annual Clean Water Performance Report, and attendant interim and final TBP report cards.

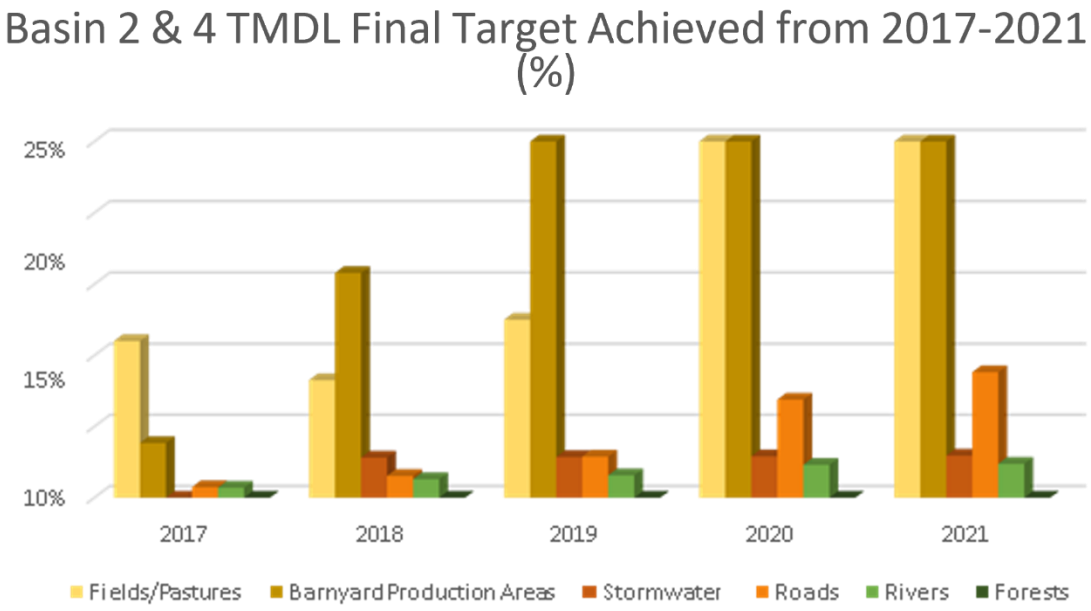


Figure 18. Basin 2 & 4 TMDL 2036 target achieved annually for each sector from 2017 to 2021.

Commitment and Strategy to Meet Targets

To meet TMDL targets, the state of Vermont has enhanced regulatory program commitments as well as established a clean water delivery framework with Act 76 (2019) that will accelerate implementation of natural resource restoration projects to meet non-regulatory target reductions. Key initiatives include:

- the creation of the state's clean water engagement strategy to develop, maintain, and enhance the Agency's organizational partnerships,
- the passage of Act 76 to support those partnerships and ensure project prioritization and funding,
- tracking and accounting methods in each sector, and
- project reporting systems to obtain an accurate reflection of phosphorus reduction through land use practices.

These initiatives are described below and in detail in Chapter 4.

Table 15. Prospective five-year and estimated final year (2036) total phosphorus reduction targets (kg/yr.).

Sector	2026 Target	Final Target
Fields/Pastures	8,108	33,731
Barnyard Production Areas	398	1,830
Stormwater	526	1,626
Roads	417	1,373
Rivers	1,527	4,694
Forests	1,953	5,860

State Programs to Meet Regulatory Targets

Regulations play a significant role in addressing the pollutants responsible for degrading water quality. Table 16 describes the regulatory programs that will support the attainment of annual TMDL reduction targets in each sector for Basin 2 & 4. These programs are also described in the sector sections and in Chapter 4. Chapter 4 provides information on priority sub-basins and towns for education, outreach, technical assistance, funding support, and implementation.

Table 16. Phase 3 regulatory programs to meet phosphorus reductions.

Source Sector*	Permit Program	Reporting Scale	Method to calculate Reduction Efficiency	Geographic Scale of TP Loading	Implementation Timeline Information
Agriculture	Required Agricultural Practices (RAPs) / Large Farm Operation (LFO) & Medium Farm Operation (MFO) Rules and Permits	HUC12	SOP	Implemented and tracked at HUC12 scale	Estimates completed at HUC12 scale per farm size inspection cycle. Certified Small Farm Operations (CSFOs) at least once every 7 years, MFOs at least once every 3 years, and LFOs annually.
Stormwater	Operational Three-acre General Permit	HUC12	35% reduction	Can estimate once three-acre GIS layer is finalized	Stormwater Program has list of when each parcel is due for permitting; once issued, site will have five-year period to implement.
	Municipal Separate Sewer System (MS4) General Permit	MS4 jurisdiction	SOP	Determined by MS4	Phosphorus control plans due 4/1/2021; methods due to be published by 11/2021.
Roads	Municipal Roads General Permit (MRGP)	Town, but have access to GIS road segments; should be possible to aggregate at HUC12 scale	SOP	Stormwater Program will provide estimate of total expected reduction	Towns must report road erosion inventories (REI) by 12/31/2020; all work to be completed by 12/31/2036; reduction timeline likely to be somewhat frontloaded due to focus on priority road segments.
	Transportation Separate Storm Sewer System (TS4) Permit	Lake Segment	TBD	TBD	Stormwater Program currently reviewing draft VTrans phosphorus control plan.
Forests**	Acceptable Management Practices (AMPs)	HUC12	SOP	Completed at HUC12 scale	Assumes that lake segments with 5% forest reduction will be achieved via increased AMP compliance.

*While no river state regulatory programs have been promulgated to achieve TMDL targets, municipal River Corridor Bylaw adoption is encouraged for target towns in Chapter 4 and Chapter 5.

** Except for the forestry sector, where an additional 40% reduction is needed to achieve reductions above the 5% reduction associated with AMP compliance alone.

Act 76 Framework to Meet Non-Regulatory Targets

The 2019 Vermont Clean Water Service Delivery Act (Act 76) provides the funding and project delivery framework to ensure the implementation of non-regulatory, natural resource projects to achieve the state's clean water goals. The Act accomplishes the following primary tasks:

1. Securing long-term funding to implement the TMDL and achieve clean water goals. The Clean Water Fund revenue will support clean water projects, which in turn will leverage other funding sources.

2. Improving the ability to prioritize and fund non-regulatory projects. These include small-scale green stormwater management practices, conservation initiatives on farms, and natural resource restoration projects such as conservation easements, wetland and floodplain restoration, and tree and shrub plantings along riparian areas. While not required, these projects are essential to achieve the water quality goals in both the Lake Champlain and Lake Memphremagog TMDLs.

3. Emphasizing the need to achieve phosphorous reduction targets for each watershed that will be supported by the establishment of Basin Water Quality Councils (BWQCs) led by regional Clean Water Service Providers (CWSPs). CWSPs are responsible for partnering with BWQCs to identify, implement, operate, and maintain non-regulatory projects to meet non-regulatory interim phosphorus reduction targets for the Lake Champlain TMDL, and for other impaired waters in Vermont as pollution budgets are established. The South Lake BWQC is formed and will be operational by 2023.

4. Requiring the dispersal of formula funds for non-regulatory projects in the Lake Champlain Basin. The formula is based on interim phosphorus reduction targets and a standard cost per unit of phosphorus reduced, consistent with "pay for performance" models. CWSP interim phosphorus reduction targets and fund allocations are in Appendix A. The approved CWSP for Basin 2 & 4 is a collaboration between the RRPC and the PMNRCD.

Engagement Strategy

The collaborative approach taken to engage stakeholders and communities in clean water planning and implementation efforts is crucial to the development and future implementation of Phase 3 of the Lake Champlain P TMDL. This approach focuses on water quality improvements through projects at the local level, with the state as a committed partner in the effort. Vermont's engagement strategy for ongoing as well as new approaches, includes:

1. Widespread collaboration with partners from multiple sectors and localities in developing, writing, and implementing TBPs;

2. Strategic inclusion and engagement with representatives of multiple sectors and localities throughout the TMDL Phase 3 basin planning process to ensure that all concerns, needs, and goals are addressed throughout the planning process;
3. Strategic communication efforts (e.g., social media, newsletters, training videos) to ensure understanding of and support for the plan among key stakeholders as well as throughout the watershed, including from underserved and disadvantaged communities;
4. Assessing gaps to address financial and technical assistance needs and developing systems to expand capacity in our stakeholder networks; and
5. Adaptive management in tracking our progress and iterative process improvement.

As a function of Act 76 program delivery, VDEC's statutory partners, who are now serving as CWSPs as well as members of recently established BWQCs. These groups will be enhancing community outreach and engagement for clean water project delivery efforts. These efforts will continue to promote widespread and improved understanding of the requirements for Phase 3, support diverse and sustained collaboration, and help in building new partnerships. As a result, the Phase 3 effort will continue to enhance shared ownership and be well informed by those working on the ground, which will enhance reasonable assurance that Vermont will achieve improvements in local water quality and the 2026 Champlain TMDL reduction targets.

TMDL Progress by Sector

Agricultural Sector

Agricultural lands make up about 19.4% of the land cover in Basin 2 & 4. Phosphorus loading from agricultural lands account for approximately 56.1% of all phosphorus loading from the Basin to Lake Champlain. The TMDL agricultural phosphorus watershed reduction goals for the Southern Lake Champlain basin are 33,730 kg TP for agricultural fields and pastures and 1,800 kg TP for barnyard production areas. These goals represent percent reductions over the modeled 2001-2010 baseline phosphorus loading estimates of 62.9% and 80%, respectively. The annual reduction achieved for 2021 was 9,407 kg (27.9% of the final target) for fields and pastures and 636 kg (34.8% of the final target) for barnyard production areas (Figure 18, Table 14).

Sub-watershed scale phosphorus loading and reduction estimates for HUC12 watersheds within Basin 2 & 4 can be examined in the interactive online report *Estimated TMDL TP Loading and Reduction*, which displays estimates for all land use sectors and HUC12 watersheds in the Lake Champlain Basin. Agricultural sectors are broken into three classes in this report: crop (or field, which is hay and cultivated crops), farm (barnyard production areas), and pasture.

Agricultural Mitigation, Tracking, and Accounting Efforts

Phosphorus loading from agricultural sources is currently being addressed by several state agencies, regulatory programs, and partner groups. These efforts include BMP implementation to reduce pollution, as well as the tracking and accounting of expected phosphorus reductions from

management actions. Results from tracking and accounting efforts are used to measure progress in meeting state and federal phosphorus reduction goals. Examples of mitigation, tracking, and accounting efforts in the agricultural sector include:

- The VAAFM developed the Required Agricultural Practices (RAPs) to minimize agricultural impacts on water quality. These practices are expected to greatly reduce phosphorus loading from agricultural sources. Tracking and accounting efforts are being recorded in a multi-partner planning database.
- Act 76 reserves 10% of agricultural phosphorus loading for mitigation by CWSPs. Act 76 also includes provisions for CWSPs to address any required phosphorus reduction targets not met by existing regulatory programs.
- The CWIP coordinates the funding, tracking, and reporting of clean water efforts for federal and state partners, including VAAFM, agricultural technical service providers (including UVM Extension and NRCDs), and CWSPs. Tracking and accounting methods as well as standard operating procedures (SOPs) for phosphorus reduction estimation are described on the clean water project tracking and accounting website.

Basin 2 & 4 Agricultural Tracking and Accounting Results

A summary of agricultural tracking and accounting work in Basin 2 & 4 is available in an online report, which details agricultural land use, phosphorus loading estimates, BMP implementation, and estimated phosphorus reductions.

Data reporting, tracking, and accounting started in 2016, which is the beginning of the 20-year TMDL implementation period. Key data include:

- In SFY 2021, over 9,300 acres of agricultural BMPs were *newly* implemented in the basin (several BMPs have multi-year lifespans and are only counted in the first year they are implemented, then carried forward for the design life of the BMP). This represents a slight decrease from 10,000 newly implemented acres in SFY 2020. Cover cropping, conservation tillage, and manure injection were the most common practices in SFY 2021.

- A little over 10,000 kg of agricultural phosphorus were estimated to have been reduced by BMP management actions in the basin in SFY 2021. Conservation tillage was responsible for the most reductions, followed by cover cropping, manure injection, and crop rotation. Overall, about 27.9% of the TMDL agricultural reduction goal was met in SFY 2021.

Basin 2 & 4 Agricultural Target Setting

The Lake Champlain TMDL mandates reductions from watershed phosphorus across a range of land use sectors. These watershed reductions are specific to the associated Lake Champlain segment to which the watershed drains. Although reductions are reported at the basin scale, for tracking and target setting purposes, these reductions were downscaled to a HUC12 scale. These HUC12-scale

targets can be compared to reported reductions to assess progress, identify new strategies, and prioritize future funding and management actions. In addition, the TMDL requires reporting on TP reduction progress in five-year increments. This five-year target setting is obtained by subtracting current-year reduction estimates and any anticipated reductions from regulatory programs from the overall TMDL sector goal and dividing into five-year segments in Equation 1:

Equation 1: $5\ year\ target = \frac{TMDL\ target - (current\ SFY\ reduction + regulatory\ reduction\ estimates)}{remaining\ TMDL\ years} * 5$

Progress on agricultural reductions in Basin 2 & 4 is summarized in an online report, which displays estimated reductions and remaining target reductions by HUC12 watershed, as well as the % of the TMDL target achieved at the tactical basin scale. Key accounting highlights include:

- Basin wide in SFY 2021, 34.8% of the total barnyard practice reduction goal was met, and 27.9% of the field practice reduction goal was met.
- McKenzie Brook and East Brook watersheds have the largest remaining agricultural reductions; however, these HUC12s have also seen the largest mitigation efforts.

Five-year agricultural targets for Basin 2 & 4 were calculated using *Equation 1* (Table 15). These targets represent a linear estimate that describes how much additional TP should be reduced over the next five years to reach the 2036 TMDL target, *given the amount of TP reduction achieved in SFY 2021*. The estimate does not include 2022 data but assumes a 15-year period from 2022 to 2036. Key agricultural target highlights include:

- Based on SFY 2021 data, the remaining agricultural TMDL goal is 24,000 kg TP. An annual cumulative reduction of approximately 1,600 kg of phosphorus from agricultural field practices is required each year from SFY 2022-2036 to meet the TMDL. The 5-year reduction target for SFY 2026 is therefore 8,100 kg of phosphorus.

- Based on SFY 2021 data, the remaining production area TMDL goal is 1,200 kg TP. An annual cumulative reduction of approximately 80 kg of phosphorus from production areas is required each year from SFY 2022-2036 to meet the TMDL. The 5-year reduction target for SFY 2026 is therefore 400 kg of phosphorus.

Developed Lands Sector

Developed lands make up about 2% of the land cover in Basin 2 & 4. Phosphorus loading from developed lands account for approximately 15.4% of all phosphorus loading from the basin to Lake Champlain. Developed lands include the general land use classes of urban, residential, and industrial areas, as well as paved and unpaved roads. The TMDL phosphorus reduction goals for developed lands are broken down by these general land use classes. In the basin, developed lands will require an annual average reduction of 1,600 kg, paved roads are 440 kg, and unpaved roads is 930 kg to meet the TMDL phosphorus reduction targets (Table 13). These developed lands targets represent percent reductions over the modeled 2001-2010 baseline phosphorus loading estimates of 21.1% for South Lake B, 18.1% for South Lake A, 7.6% for Port Henry, and 15% for areas of Basin 2 & 4 within the Otter Creek lake segment. The annual reduction achieved for 2021 was 169 kg which is 6.6% of the final target (Figure 18, Table 14). Based on current year data, an annual cumulative reduction of 188.7 kg of phosphorus from developed lands is required from 2021 to 2036 to meet the TMDL goal.

Stormwater Mitigation, Tracking, and Accounting Efforts

Phosphorus loading from developed lands is currently being addressed by several state agencies, regulatory programs, and partner groups. These efforts include the implementation of BMPs to reduce pollution, as well as the tracking and accounting of expected phosphorus reductions from management actions. Tracking and accounting results are used to measure progress in meeting state and federal phosphorus reduction goals. Examples of mitigation, tracking, and accounting in the developed lands sector include:

- The Municipal Roads General Permit (MRGP) Program. MRGP requires towns to stabilize road drainage systems to minimize stormwater-related erosion.

- The 3-acre permit program. This permit applies to parcels with 3 or more acres of impervious surface and requires stormwater capture and treatment.

- The Transportation Separate Storm Sewer System (TS4) permit. This permit requires the development of phosphorus control plans (PCPs) for impervious surfaces owned or controlled by the Vermont Agency of Transportation within the Lake Champlain Basin.

- Municipal Separate Storm Sewer System (MS4) permits. MS4 permits also require the development of PCPs to reduce phosphorus from stormwater. There are no MS4s in this basin.

- Act 76. Act 76 directs Clean Water Service Providers (CWSPs) to address any required phosphorus reduction targets not met by existing regulatory programs, including developed lands.

- The Clean Water Initiative Program (CWIP). CWIP coordinates the funding, tracking, and reporting of clean water efforts for federal and state partners, including CWSPs. Tracking and accounting methods as well as standard operating procedures (SOPs) for phosphorus reduction estimation can be found the clean water project tracking and accounting website.

Stormwater Tracking, and Accounting Results

Table 14 summarizes developed lands TP reductions in Basin 2 & 4 by SFY. TP mitigation from roads has seen the most development, with approximately 9% of the TMDL reduction goal achieved in this sector. Additional reductions are expected as regulatory programs in this sector get underway.

Stormwater Target Setting and Accounting

Target setting for stormwater must account for anticipated reductions from regulatory programs. These programs have timelines that dictate when work will be undertaken. Reduction estimates for two programs in the basin, MRGP and the 3-acre permit, are summarized in Figure 19, along with achieved developed lands reductions reported by CWIP. These regulatory program reductions are expected to occur over the life of the TMDL period.

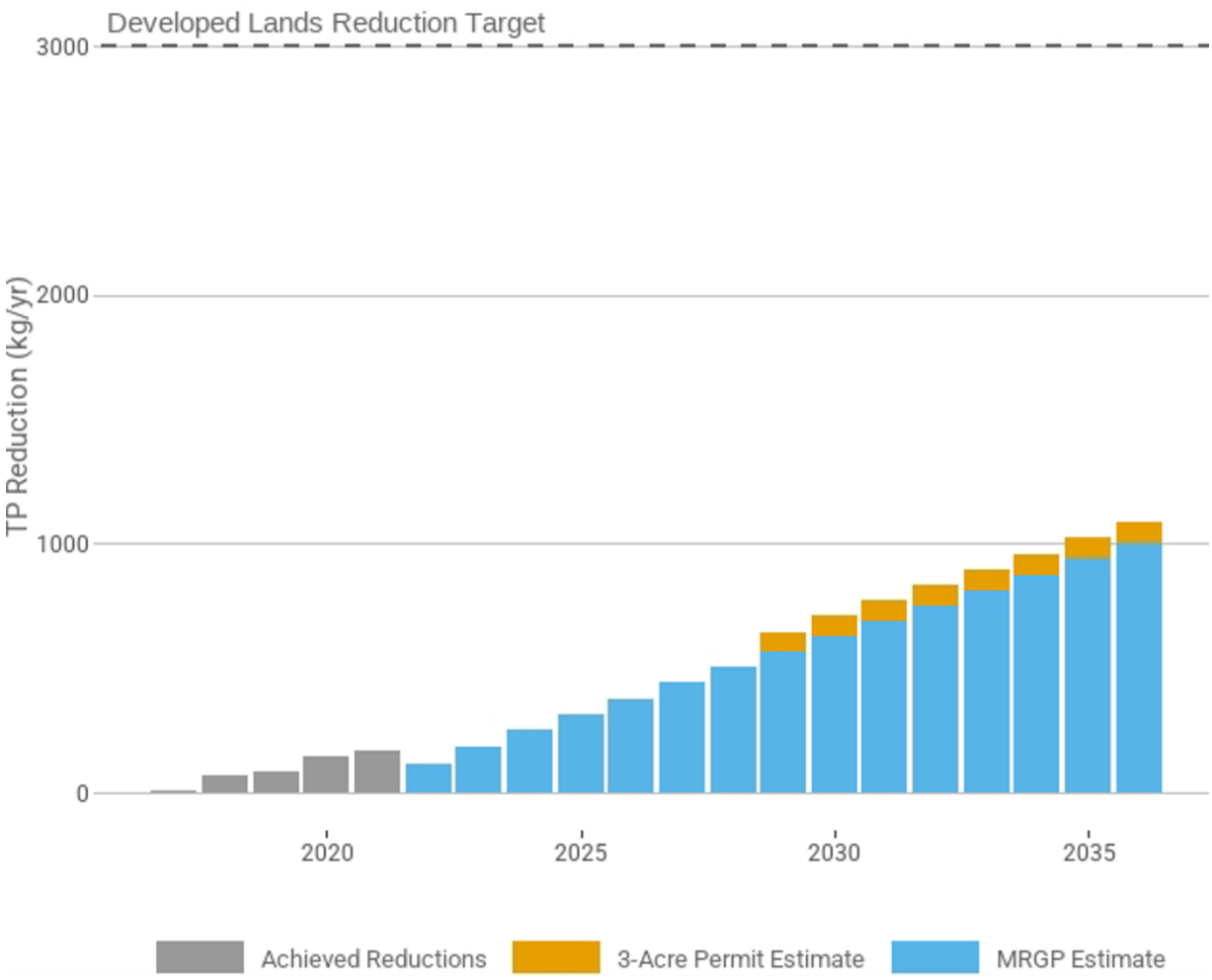


Figure 19. Achieved developed lands TP reductions and anticipated reductions from regulatory stormwater programs. The developed lands target reduction for Basin 2 & 4 is approximately 3,000 kg/yr.

In total, a little over 1,000 kg of TP from developed lands is expected to be mitigated by these two regulatory programs in Basin 2 & 4. Using *Equation 1* above, the 5-year target for developed lands reductions in the basin can be calculated by considering SFY 2021 reductions and anticipated regulatory reductions.

Key developed lands target highlights include:

- The TMDL developed lands reduction goal in Basin 2 & 4 is approximately 3,000 kg TP. Reductions from MRGP and 3-acre permit programs are estimated to mitigate about 30% of this amount. SFY 2021 reductions from developed lands in Basin 2 & 4 are about 170 kg TP.

- The 5-year target for developed lands in Basin 2 & 4 is 582 kg TP (Table 15), which is an increase of 410 kg over what was achieved in SFY 2021.

TP load reduction from developed lands that is not addressed by regulatory programs will be

assigned to CWSPs for mitigation. The CWSPs will support the implementation of non-regulatory practices needed to fill the anticipated gaps between these interim five-year targets for roads and developed lands and phosphorus reduction achieved through other sector-based regulatory programs. CWSP interim phosphorus reduction targets and fund allocations are in Appendix A. An adaptive management approach will be used for accounting and target setting and any revisions will be documented in subsequent TBPs and the CWIPs Annual Performance Reports.

It is worth noting that the area attributed to roads in the Lake Champlain TMDL SWAT model was based on an older land use/land cover (LULC) dataset and modeling and exceeds more recent and precise estimates of impervious road area based on newer LULC data published by the Lake Champlain Basin Program in 2011 (LCBP 2011). The original larger TMDL road surface area results in larger estimates of phosphorus loading, and associated load reduction potential than current tracking and stormwater permit reduction estimates, which are based on the smaller areas from the LCBP 2011 impervious surface analysis. Further analysis based on the LCBP 2016 1-meter resolution LULC dataset is expected to further refine the current road surface areas, associated loading, and load reduction potential through MRGP implementation and may provide more clarity on the magnitude of refinement needed. VDEC plans to fully evaluate options for how to refine loading estimates and targets in the near term.

Wastewater Sector

The 59 Wastewater Treatment Facilities (WWTF) that contribute phosphorus to the Lake generate a very small percentage of the overall phosphorus loading (currently only about 3%). WWTFs in Vermont require an average reduction of 42.1% in the Lake Champlain basin to meet Vermont's phosphorus reduction goals.

The TMDL presents a wasteload allocation for phosphorus loads, to which each facility in the basin will adhere. A wasteload allocation was assigned to the South Lake A and B segments (Table 13). In the 2016 Lake Champlain TMDL, reductions in wasteload allocations were targeted only to WWTFs in lake segment watersheds where the permitted wastewater load as of 2016 represents a significant (defined as being 10% or greater) portion of the total phosphorus load to that segment from all sources and/or where wastewater upgrades would meaningfully reduce the phosphorus reduction burden placed on non-wastewater (i.e., non-point) sources.

The EPA also determined that wastewater facilities with a design flow of < 0.1 MGD will keep their permitted load as of 2016 due their minor contribution of phosphorus loading. Updates and information on permits for WWTFs in Basin 2 & 4 are found in Chapter 4.

Rivers Sector

River instability in Basin 2 & 4 accounts for approximately one percent of phosphorus loading to Lake Champlain. These areas will require an average reduction of 46.7% or 4,694 kg/year to meet Vermont's Lake Champlain TMDL phosphorus reduction targets (Table 13). The annual reduction

achieved for 2021 was 112 kg which is 2.4% of the final target (Figure 18, Table 14). Based on current year data, an annual cumulative reduction of 305 kg of phosphorus from the rivers sector is required from 2021 to 2036 to meet the TMDL goal. The five-year reduction target for 2026 is 1,527 kg of phosphorus (Table 15). This represents an increase of 1,415 kg of phosphorus over what was achieved in 2021.

Rivers sector reductions are expected to be achieved by implementing projects identified in Stream Geomorphic Assessments, River Corridor Plans, and the Functioning Floodplain Initiative tool, and through the adoption and implementation of municipal regulations to protect river corridors.

Stream Stability Restoration through the Functioning Floodplains Initiative

Assessing stream and floodplain function supports the valuation of ecosystem services and the potential for natural resource restoration opportunities. Societal benefits such as safe swimming, fish and wildlife, public safety, and property protection may be categorized under the general ecosystem services of water quality, ecological integrity, and flood resilience.

The Functioning Floodplains Initiative (FFI) was launched in 2019 to contract with a consulting team of professional practitioners and researchers. The goal of the FFI is to provide practitioners, program managers, and policymakers with the maps and data they need to protect and restore highly valued streams, wetlands, riparian areas, and floodplains in the Lake Champlain Basin.

The FFI team is developing methodology for a project credit scoring system that rewards phosphorus load reducing practices, as derived from the Lake Champlain TMDL baseload allocations, for stream instability using the Soil Water Assessment Tool (SWAT). This will result in a phosphorus crediting system that quantifies the gains made towards river system equilibrium.

There are three types of river and floodplain load reduction credit types for river instability. They are:

1. Stream stability reconnection credits for projects at reach and watershed scales.
    - Reductions over time (e.g., 10 lbs./yr. over 10 years).
    - River Corridor Easement (RCE) projects to achieve equilibrium and pollution reduction credits over time.

2. Storage attenuation credits for projects that reconnect floodplains and wetlands.
    - Driven by the deposit of sediment/nutrients when floodplains flood.
    - Longer-term pollution reduction credits may diminish over time.

3. Sediment removal credits for projects that physically remove sediment when a floodplain feature is constructed, especially along incised channels (first year credit only).

The river instability baseload will be distributed to the reach scale by using TMDL sub-watersheds as the components of each HUC12 to develop the total HUC12 allocation. The HUC12 load allocation is then downscaled to the reach level using an "area weighted" reach assignment.

The FFI project team established a relationship between the connectivity score and phosphorus allocation, whereby the higher the connectivity score, the more the phosphorus reduction target is achieved. This relationship demonstrates that restoring the most disconnected reaches will achieve the most phosphorus reduction. From a target-setting perspective, project implementers (under the Act 76 framework) should target those reaches where we expect to see the highest pollution reductions. This crediting system will consider "stacked" practices (e.g., protection + riparian buffers). VDEC will devise how this will be quantified and reported on in our tracking and accounting systems.

Going forward, the river instability phosphorus scoring, and crediting system will be based on the increments of restored and protected connectivity, with the highest project credits awarded in areas with higher baseload allocations. In other words, the size of the connectivity credit awarded to a project is commensurate with degree to which geomorphic equilibrium is restored.

Forestland Sector

Forestlands in the basin account for approximately 15.5% of phosphorus loading to Lake Champlain. These areas will require an average reduction of 11.9% or 5,860 kg/year to meet Vermont's Lake Champlain TMDL phosphorus reduction targets (Table 13). The Agency expects to partially meet forestland reduction targets through AMP compliance and forestland conservation for the South Lake Champlain Basin. However, due to the relatively high percentage of forestlands relative to other land uses in the basin, there will be the need to achieve greater target load allocations that won't be met through VT AMP compliance alone. As a result, there will be a greater emphasis on achieving additional reductions through the implementation of natural resource restoration projects and forestry BMPs in the basin.

Targeting forestland BMPs in areas contributing the highest phosphorus and sediment loads is challenging. In other sectors, such as the developed lands sector, source areas are well understood and characterized using spatial data with a high degree of accuracy. Additionally, these areas are generally accessible and have the advantage of unobscured aerial imagery to allow verification of mapped conditions. As a result, BMPs can be located to manage high loading areas on developed lands with precision. However, for forestland and rivers, conducting higher resolution spatial data analysis is variable and other methods and analytical tools are in development to enhance project identification and prioritization.

Mapping Critical Source Areas & Identifying Legacy Erosion

As an outcome of the requirements of Act 76 (2019), and with support from the LCBP, the ANR has contracted with a consultant team to identify and map critical source areas of forestland and establish a method to estimate the potential for phosphorus and sediment reductions associated with forestland BMPs and AMPs. This consultant will assist the State of Vermont in identifying forestland phosphorus and sediment reduction potential using a LiDAR landscape analysis of erosion risk potential and critical source area (CSA) mapping of forest roads, trails, and log landings in Vermont. These features will be prioritized based on their erosion risk potential. In addition, this work will

establish forestland BMPs phosphorus and sediment accounting methods to estimate phosphorus and sediment load reductions associated with BMP and AMP implementation on lands in the Use Value Appraisal Program (see Chapter 4 for more information).

In the second phase of work, the consultant will further assess forestlands to identify and prioritize legacy erosion associated with the critical source areas and to ground truth and calibrate the analytical and prioritization tools. The ground truthing of the landscape analysis is intended to calibrate the prioritization framework of critical source areas, as well as to develop a prioritization framework to address legacy erosion in high priority basins (i.e., South Lake Champlain and Missisquoi Bay) to achieve target load allocations for lake segments that will not meet reduction targets through Vermont AMP compliance alone.

Forestland Accounting

Until this consultant work is complete, the calibration of the phosphorus and sediment accounting methods, to estimate phosphorus and sediment load reductions associated with forestland BMP implementation, will be in development. As such, this iteration of the Phase 3 will not include the projected forestland BMP reduction estimates or forestland BMP targets. In lieu of having specific forestland BMP implementation targets, other than AMP compliance, VDEC will provide natural resource targets on the major river basin scale (i.e., HUC08) that is inclusive of all natural resource restoration categories (e.g., including river corridor and floodplain restoration and protection, wetland restoration and protection, riparian and lakeshore restoration and protection, natural woody buffer establishment) as well as forestland AMP and BMP implementation.

Chapter 4 – Strategies to Address Pollution by Sector

Tactical basin plans address water quality by land use sector (Figure 20). The following sections provide specifics about protection and restoration efforts underway or recommended for each source sector to meet water quality objectives. A summary table of the strategies for each sector is found in the Executive Summary in Table 1. A detailed list of priority strategies by source sector is included in Chapter 5 in the Implementation Table.

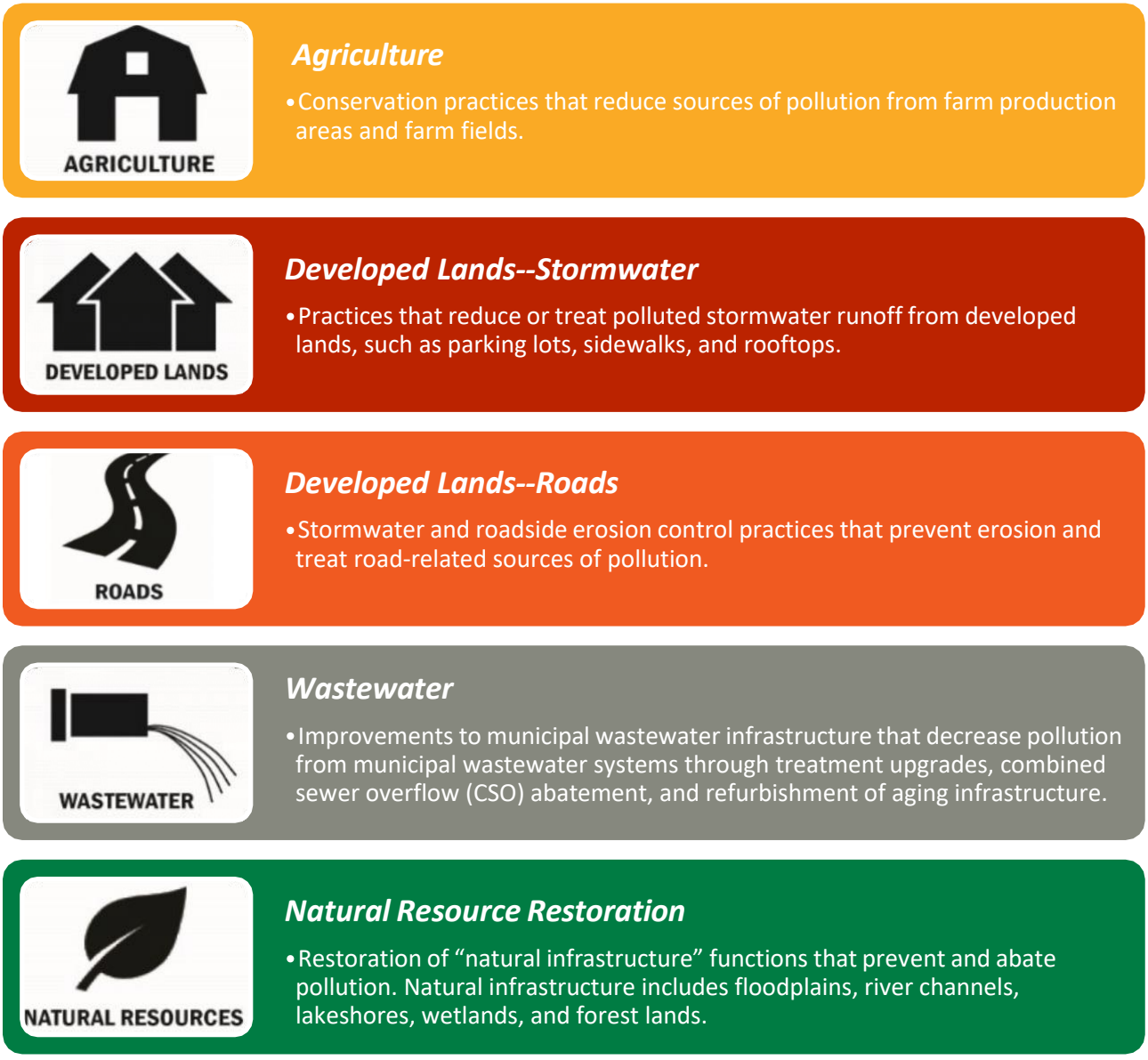


Figure 20. An illustration of the land use sector framework and practices used in Tactical Basin Planning to enhance, maintain, protect, and restore water quality.

A. Agriculture

Agricultural land use makes up approximately 19% of the land cover in Basin 2 & 4. Three percent is cultivated crop and 16% is hay or pasture. The highest concentration of agricultural lands are found in the McKenzie Brook and East Creek watersheds. An analysis comparing acreage of implemented field practices (FY2017-2021) to agricultural concentrations in the HUC12s showed that implementation was highest in the areas with the highest concentrations of agriculture.

Eighty percent of the conservation practice acreage implemented from 2017 to 2021 occurred in the McKenzie Brook, East Creek, and Hoisington Brook watersheds, which were prioritized in the 2017 Basin 2 & 4 TBP as high phosphorus loading watersheds. Conservation tillage, cover cropping, and manure injection practices were the most popular field BMPs in the basin (Figure 21). The increased prevalence of farms and agricultural activities in these sub-basins make them a priority for outreach and implementation of field and farmstead practices as well as innovative programs and projects for water quality.

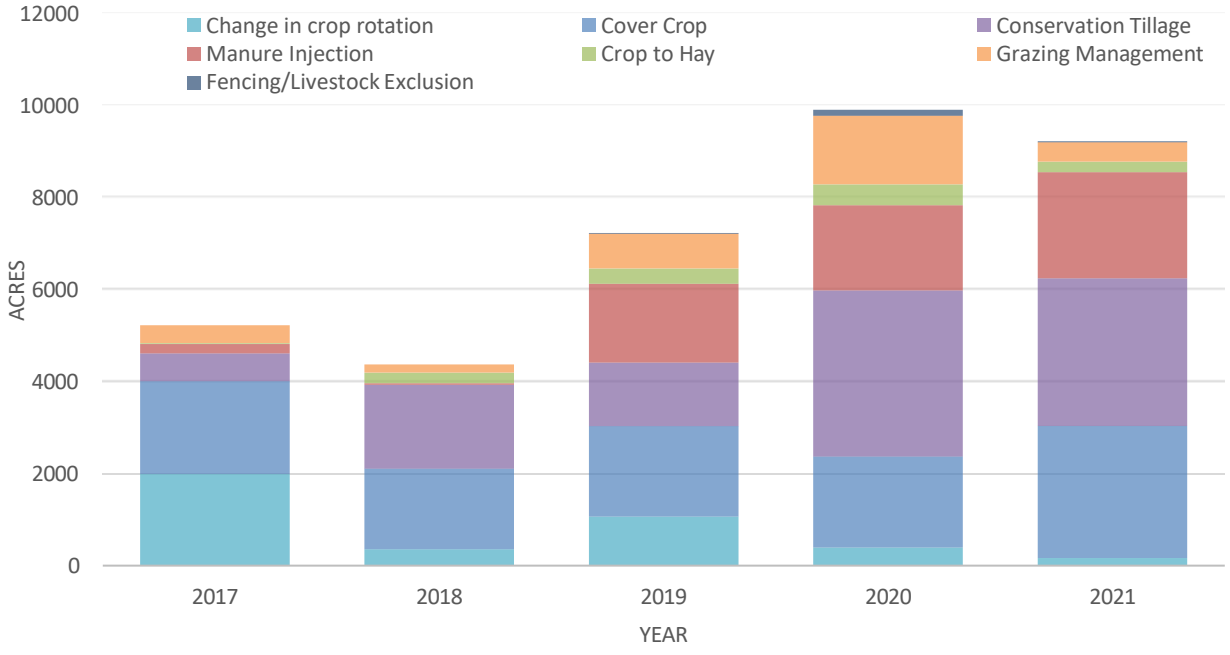


Figure 21. Acreage of field BMPs installed in Basin 2 & 4 from State FY2017-2021.

There are currently three permitted Large Farm Operations (LFOs) and 11 permitted Medium Farm Operations (MFOs) in Basin 2 & 4. LFOs are inspected annually and MFOs are inspected once every three years by the VAAFM. These farms must comply with the RAPs, LFO or MFO permitting program requirements as applicable, and the VWQS.

An estimated 30 Certified Small Farm Operations (CSFOs), that are required to certify annually with the Agency, will be inspected at least once every seven years, and need to comply with the RAPs.

The VAAFM estimates there are 70 Small Farm Operations (SFOs) in the basin that do not meet the thresholds of a CSFO and are not required to receive a routine inspection by VAAFM, but still need to comply with the RAPs. Full understanding of SFOs active in the basin may rely more on local agricultural partners because much of the VAAFM's data tracking focuses on farms that have annual reporting requirements or are routinely visited (CSFOs, MFOs, and LFOs). It is also important to acknowledge that the agricultural landscape is changing rapidly, especially for smaller dairy farms, which have been in flux as many farmers have gone out of business, downsized, or shifted management. This underscores the key role of local agricultural partners in providing education and outreach to SFOs around RAPs and implementation of field and farmstead practices for water quality. Additional assessments through voluntary farm visits will help to locate areas for targeted action.

Regional agricultural partners are essential service providers that assist farms directly through education, outreach, and technical assistance, and can leverage additional resources and financial assistance for farms. The PMNRCD is partnered with the Bennington County NRCD and Rutland County NRCD to form the Southwest Regional Partnership with support from the VAAFM Agricultural Clean Water Initiative Program (ACWIP). The partnership serves farmers and producers in Bennington and Rutland Counties and employs two agricultural outreach specialists to provide a variety of services, education, and outreach to farmers with support from the district managers. Services currently offered include: equipment rental, soil and manure sampling, manure cart weights, NMP development, consultations on BMPs to address water quality issues, and referrals to funding programs or agencies. The partnership also provides education and outreach through on-farm visits, mailers, workshops, and articles in publications like AgriView. Sustaining and coordinating with these groups is an important strategy in this plan to effectively target agricultural BMP implementation to improve water quality.

In addition, regional Vermont Agriculture Water Quality Partnership (VAWQP) meetings will allow for regular collaboration and reporting on basin planning efforts in the different regions. This increased collaboration will lead to effective use of time and resources and reduce redundancy in agricultural work and technical assistance in Basin 2 & 4.

The USDA Natural Resources Conservation Service (NRCS) has extensive funding that provides technical and financial assistance for farmers to improve agricultural practices that address agricultural and natural resource concerns, increase farm viability, protect water quality, and improve soil health. These resources can be found on the NRCS website.

The VAAFM is also coordinating with agricultural partners throughout the watershed to streamline outreach to farmers where multiple resources may be available. A primary collaboration tool used by the NRCDs, UVM Extension, and VAAFM is the Multi-Partner Agricultural Conservation Practice Tracking and Planning Geospatial Database (Partner Database), which was launched in 2019. This coordination reduces incidences of duplicative strategies by multiple organizations and clarifies the outcomes of partner outreach and coordination for better farmer assistance.

VAAFM provides a spectrum of assistance programs and resources (both technical and financial) that are available to farmers to improve agricultural practices that increase farm viability and protect water quality. These resources can be found at the VAAFM website.

Beginning in 2022, VAAFM implemented the Vermont Pay-for-Phosphorus Program (VPFP), which provides performance-based payments to Vermont farmers for reductions in phosphorus losses from their agricultural fields. Reductions represent improvements in farm management from the management assumed in the Lake Champlain P TMDL. Enrolled farms will receive payment for annual net reductions from these historic base loading assumptions, above a threshold set by the program. In Basin 2 & 4, five farms completed Phase 1 (Data Entry) during the first year of the VPFP Program.

The VPFP Program will enroll farms for the 2022 through 2025 cropping seasons with the expectation that farm enrollment will increase with each year, so more payments will go to more farms each year. This program is a new approach to improve land stewardship on farmland and water quality by using a performance-based payment model. The VPFP Program will accelerate agricultural water quality improvements with new funding to incentivize and value a farmer's agricultural land stewardship efforts. This program will help to fill gaps where funding is a barrier to voluntary actions.

From state fiscal year 2017 to 2021, over $5.2 million in state funding was dedicated to improving water quality in the Basin 2 & 4 agricultural sector through conservation practices, forest and grass buffers, livestock exclusion, barnyard and production practices, land conservation, equipment implementation, and technical assistance. Most of the funding went to high priority conservation practices identified in the 2017 South Lake Champlain TBP.

The strategies in the Chapter 5 Implementation Table were informed by agricultural community partners and focus on coordinating conservation efforts between farmers and agricultural service providers, outreach, education, and technical assistance for increased implementation of farm and field practices, as well as supporting adoption of conservation practices through innovative equipment.

B. Developed Lands

Stormwater runoff from developed lands, including the road network, is a significant threat to water quality in Vermont. Stormwater runoff is any form of precipitation that flows over the land during or after a storm event or because of snowmelt. On undeveloped lands, like forests and wetland meadows, a portion of this runoff is absorbed into the ground through infiltration and the rest takes a relatively slow path to nearby rivers, lakes, and ponds. On developed lands, however, infiltration is reduced by impervious surfaces such as roads, rooftops, and driveways, which also increases the velocity and volume of polluted runoff into rivers and lakes. This leads to an increased frequency and intensity of flooding as well as a greater likelihood that runoff will become contaminated with

pollutants. The result is increased erosion and property damage, degraded aquatic and terrestrial habitats, and threats to public health via recreation sports and contaminated drinking water.

Seventeen of the 18 stormwater strategies and actions identified in the 2017 plan were in progress or completed by release the of this plan. Municipalities, watershed groups, RPCs, and NRCDs were successful in collaborating on the development of Stormwater Master Plans and the pursuit of the projects identified in these plans. These groups were also essential in ensuring that all the towns in the watershed were following the MRGP in 2021. The next phase of this work is the implementation of the required and voluntary practices identified in the plans and assessments. The required practices are explained in the regulations below, while the highest priority voluntary practices will be carried out by municipalities with aid from statutory watershed partners.

Stormwater (Urban & Residential non-road)

This section integrates basin-specific information on stormwater-related water resource impairments, regulatory programs, stormwater master plans, Illicit Discharge Detection and Elimination (IDDE) studies, existing implementation efforts and partnerships to inform strategies to address stormwater-related water resource impairments. The tactical basin planning approach engages local, regional, and federal partners in the development of strategies needed to accelerate adoption and monitoring of stormwater related BMPs to meet the state's clean water goals including reductions to support the Lake Champlain Phosphorus TMDL. The section is organized around the three-acre general permit, stormwater master planning, and IDDE studies which are the primary drivers for implementation efforts in the basin.

In the last five years, stakeholders in Basin 2 & 4 have been actively participating in voluntary actions, developing Stormwater Master Plans (SWMPs), and designing and implementing priority projects identified in the SWMPs. Most towns are on track for meeting regulatory requirements and have been actively working to remediate discharges identified through IDDE studies.

Stormwater General Permit 3-9050 (Three-Acre General Permit)

General Permit 3-9050 is a permit for stormwater runoff from impervious surfaces. It is an important component of the Vermont Clean Water Act of 2015 (Act 64) and is designed to assist in the implementation of clean-up efforts in Lake Champlain, Lake Memphremagog, and stormwater-impaired waters, while also protecting high quality surface waters statewide. This general permit covers all operational stormwater permitting, including new development, redevelopment, and permit renewal. Additionally, this general permit serves as the "Three-Acre General Permit" as required under the Vermont Clean Water Act. Parcels in the Lake Champlain watershed, including Basin 2 & 4, will need to apply for permit coverage by 2023. There are 32, three-acre-sites in the basin covering approximately 118 impervious acres. The Agency is presently making available grant funding in the form of rebates for individual landowners, while municipalities can access Clean Water funding and/or subsidized loans. Program development for SFY 2022-2025 will be supported by an infusion of American Rescue Plan Act (ARPA) funds. Two programs developed to

address these sites are the Public Private Partnership project and grant incentive and the Green Schools Initiative.

In addition, on July 1, 2022, barring some transitional exemptions, projects that expand or redevelop a half-acre (0.5 acres) or more impervious surface are required to apply for stormwater operational permit coverage. Additional information on the ½ acre threshold is available from the Stormwater Program.

Public Private Partnership

Through a pilot project, VDEC is currently investigating how best to assist private landowners with permit compliance where it will also result in public entities meeting other water quality or public-interest goals. The Public Private Partnership (P3) project identified partnership opportunities with the goal of moving ten private properties that come under jurisdiction of the three-acre general permit forward to the 30% design phase. These ten can then be shared as models on how to bring a three-acre property closer to compliance with the new rule while simultaneously meeting some outcomes for public good. Seven of these projects are being advanced to construction using ARPA funding. Although no projects or designs have been developed for Basin 2 & 4, if more P3 funding becomes available, this program is highlighted as an opportunity in the Implementation Table in Chapter 5.

Green Schools Initiative

The Lake Champlain Basin Program is partnering with VDEC to provide block grants through the Green Schools Initiative. The grants aim to have stormwater design and permitting work completed on behalf of schools in the Lake Champlain Basin. Public schools and colleges in the Lake Champlain Basin that are required to obtain three-acre general permit coverage (3-9050) will be able to sign up to receive technical and financial assistance for stormwater design and permit obtainment.

The Green School Initiative will also partner with Lake Champlain Sea Grant to provide stormwater education and outreach to school communities. Lake Champlain Sea Grant will provide schools with watershed and stormwater lesson plans as well as training for students and teachers. In addition, Lake Champlain Sea Grant will help schools identify ways to maximize the additional benefits of green stormwater projects, such as creating pollinator habitat and outdoor classrooms. Most schools in Basin 2 & 4 have received preliminary assessments and conceptual designs as part of a town wide SWMP. The three-acre schools in Basin 2 & 4 are included in the Implementation Table in Chapter 5: Green Mountain College, Castleton-Hubbardton Union School District, Castleton State College, Slate Valley Unified Union School, and the Poultney School District.

Stormwater Mapping and Master Planning

Stormwater infrastructure mapping projects are completed for municipalities by the Vermont Clean Water Initiative Program to supplement any existing drainage data collected by towns and with the intention of providing a tool for planning, maintenance, and inspection of the stormwater

infrastructure. Stormwater mapping reports are complete for all recommended towns in Basin 2 & 4 except Bridport, Sudbury, and Wells (Table 17). The reports can be found by clicking the links in the table or from the Stormwater Program.

The reports and maps from each project are meant to provide an overall picture and understanding of the connectivity of the storm system on both public and private properties to raise the awareness of the need for regular maintenance. These reports identify potential priority projects in the study areas and provide information necessary to develop a stormwater master plan.

Projects identified as high and medium priority in the stormwater mapping reports and master plans may be implemented by towns with the aid of watershed partners where necessary. All towns with significant development adjacent to surface waters have developed a stormwater master plan in Basin 2 & 4 and the priority projects in those plans should be pursued. For those towns with less development, a singular project identified by a stormwater mapping report can be developed.

Table 17. Towns with completed SWMPs and mapping reports (SMR). Click on the town to link to report.

Town Name*	Year Completed	Type	Recommendations for Implementation	# of projects implemented, pursued, or in progress	Priority Projects identified
Addison	2021	SMR	Implement priority projects	0	3
Benson (and West Haven, Middletown Springs, Fair Haven, Poultney)	2022	Poultney River SWMP	Implement priority projects	10	20
Bridport	2021	SMR	Implement priority projects	0	2
Castleton (and Ira and West Rutland)	2017	Castleton Headwaters SWMP	Implement priority projects	5	12
Danby	2017	SMR	Implement priority projects	0	2
Dorset	2018	SMR	Implement priority projects	0	3
Ferrisburgh	2021	SMR	Implement priority projects	0	1
Hubbardton (and Castleton)	2016	Lake Bomoseen Watershed SWMP	Implement priority projects	6	20
Orwell	2015	SMR	Implement priority projects	0	3
Pawlet (and Tinmouth and Danby)	2015	Flower Brook SWMP	Implement priority projects	6	13
Shoreham	2015	SMR	Implement priority projects	0	1
Wells (and	2019	Wells River	Implement priority projects	6	20

Poultney and Tinmouth)		and Lake St. Catherine SWMP			

*Towns with mapping or plans that do not have priority projects in Basin 2 & 4 were not included. **SWMP** = Stormwater Master Plan.

Illicit Discharge Detection & Elimination Studies

In 2000, the Vermont Legislature required VDEC to implement a statewide program to promote detection and elimination of improper or illegal connections and discharges. Illicit discharges are discharges of wastewater or industrial process water into a stormwater-only drainage system. All towns in Basin 2 & 4 have completed IDDE reports or have no suspected problems except Panton, Shoreham, Orwell, Sudbury, Hubbardton, West Haven, Wells, Tinmouth, Danby, Rupert, Dorset, and Ira (see map).

The outcomes of these studies are listed in three reports:

- Advanced Illicit Discharge Investigations in the Lamoille River, Otter Creek, and Poultney River Basins Final Report (2019)
- Advanced Illicit Discharge Investigations in the Lamoille River, Otter Creek, and Poultney River Basins Final Report (2019)
- Advanced Illicit Discharge Investigations in the Lamoille River, Otter Creek, and Poultney River Basins Final Report (2021)

In Basin 2 & 4 most illicit discharges were identified and eliminated. Follow-up actions were identified in the reports where sources were difficult to locate, compliance was difficult, or the infrastructure was no longer in use. This plan recommends the completion of IDDE studies and mapping in the towns above, follow-up on recommended actions from previous studies, and the elimination of discharges identified by new studies (e.g., Pawlet and Fair Haven).

Vermont Green Infrastructure Toolkit

Many of the stormwater issues associated with developed lands can be mitigated and prevented using Low Impact Development (LID) and Green Stormwater Infrastructure (GSI) systems and practices. These emerging concepts strive to manage stormwater and pollutants by restoring and maintaining the natural hydrology of a watershed. Rather than funneling stormwater off site through pipes and infrastructure, these systems (gardens or permeable materials) focus on infiltration, evapotranspiration, and storage as close to the source as possible to capture runoff before it gets to surface waters.

The Vermont Green Infrastructure Toolkit is a project of the ten Regional Planning Commissions of the Vermont Association for Planning and Development Agencies (VAPDA) and the Vermont Agency of Natural Resources' Water Investment Division. The toolkit is a clearinghouse of information useful to Vermont municipalities to explore how to promote the adoption of Green Infrastructure policies and practices to combat the problems caused by urban, suburban, and rural stormwater runoff. Outreach is recommended to support bylaw development for stormwater

management of road segments receiving stormwater runoff in priority catchments in West Rutland, Castleton, Dorset, Wells, West Haven, Benson, Orwell, and Poultney. Additionally, outreach by the Regional Planning Commissions is encouraged in towns that have contemplated stormwater management, where population growth is likely, and impervious surface is moderate to high.

Roads

It is estimated that more than 75% of Vermont roads were constructed prior to any requirements for managing stormwater runoff (Vermont Agency of Natural Resources, 2012). Where road networks intersect stream networks, roads and their ditches effectively serve as an extension of the stream network. Runoff from roads can increase stormwater runoff and, in this basin unpaved roads are an important source of sediment to receiving waterbodies. Roads can also impinge on stream floodplains and be a barrier to aquatic organism passage (AOP) with undersized culverts. In Basin 2 & 4, road runoff results in sediment, phosphorus, and chloride loading to adjacent waterbodies.

This section integrates basin-specific information on road-related water resource impairments, regulatory programs such as the MRGP, existing implementation efforts, and partnerships to inform strategies to address road-related water resource concerns.

Tactical basin planning engages local, regional, and federal partners needed to accelerate transportation-related practice implementation in the development of these strategies to achieve the state's clean water goals. The following details information about regulatory programs including the Transportation Separate Storm Sewer System Permit (TS4) and the MRGP as they are the driving road water quality implementation efforts in the basin.

Municipal Roads General Permit

Road Erosion Inventories (REI) are used by Vermont municipalities to:

- identify sections of local roads in need of sediment and erosion control,
- determine individual road segment compliance with MRGP required practices,
- prioritize road segments that pose the highest risks to surface waters, and
- estimate costs to remediate those sites using Best Management Practices.

REI's are required by the Municipal Roads General Permit (MRGP). The MRGP is intended to achieve significant reductions in stormwater-related erosion from municipal roads, both paved and unpaved. The permit is required by the Vermont Clean Water Act (Act 64) and the Lake Champlain Phase 1 TMDL.

The implementation of the priorities identified in REI's will reduce sediment, phosphorus, and other pollutants associated with stormwater-related erosion generated from unpaved municipal roads that contribute to water quality degradation. A secondary benefit of upgrading roads to MRGP standards is improving the flood resilience of the municipal transportation system from the increased frequency of localized high intensity rain events associated with climate change. The inventories are conducted for "hydrologically- connected roads". Hydrologically connected roads are those municipal roads within 100' of or that bisect a wetland, lake, pond, perennial or intermittent stream or a municipal road that drains to one of these water resources. These road segments can be

viewed using the "Municipal Road Theme" on the ANR Natural Resource Atlas and REI results by town can be view in the MRGP Implementation Table.

Based on protocols developed by VDEC with the assistance of the Regional Planning Commissions (RPCs), all the towns in Basin 2 & 4 have completed REIs. Towns are required to bring 15% of connected segments scoring *Partially Meeting* or *Not Meeting* to the MRGP standards or *Fully Meeting* status by December 31, 2022. *Very High Priority* connected segments will have to meet standards by December 31, 2025, for all road types, except for Class 4 roads, which will have to meet standards by December 31, 2028. Towns will report and manage their progress annually via the MRGP Implementation Table Portal database. For additional information see the VDEC Municipal Roads Program.

VDEC will be re-issuing the MRGP in January 2023. The re-issued permit will continue the implementation requirements of the previously issued permit, requiring towns to upgrade at least 7.5% of their non-compliant segments to meet MRGP standards annually. The re-issued permit will require a second, town-wide reassessment of all hydrologically connected segments by the Fall of 2027. After the new REI is completed, 20% of total Very High Priority segments will be required to be upgraded to meet MRGP standards each year, as part of the 7.5% annual requirement mentioned above.

This plan recommends that technical and financial assistance be provided to towns to complete the new, required REIs and for towns interested in implementing road projects with water quality benefits. Projects that "do not meet standards" and/or are in sub-basins with sediment impairments related to road stormwater runoff are water quality priorities (Figure 22).

Resources available from the Clean Water Fund (e.g., VTrans Municipal Grants-in-Aid, Grants- Aid-Small Equipment grant, VTrans Better Roads grants) assist with development of designs, capital budgets, cost estimates and implementation of road projects. Completion of these projects may be counted towards meeting the requirements of the MRGP.

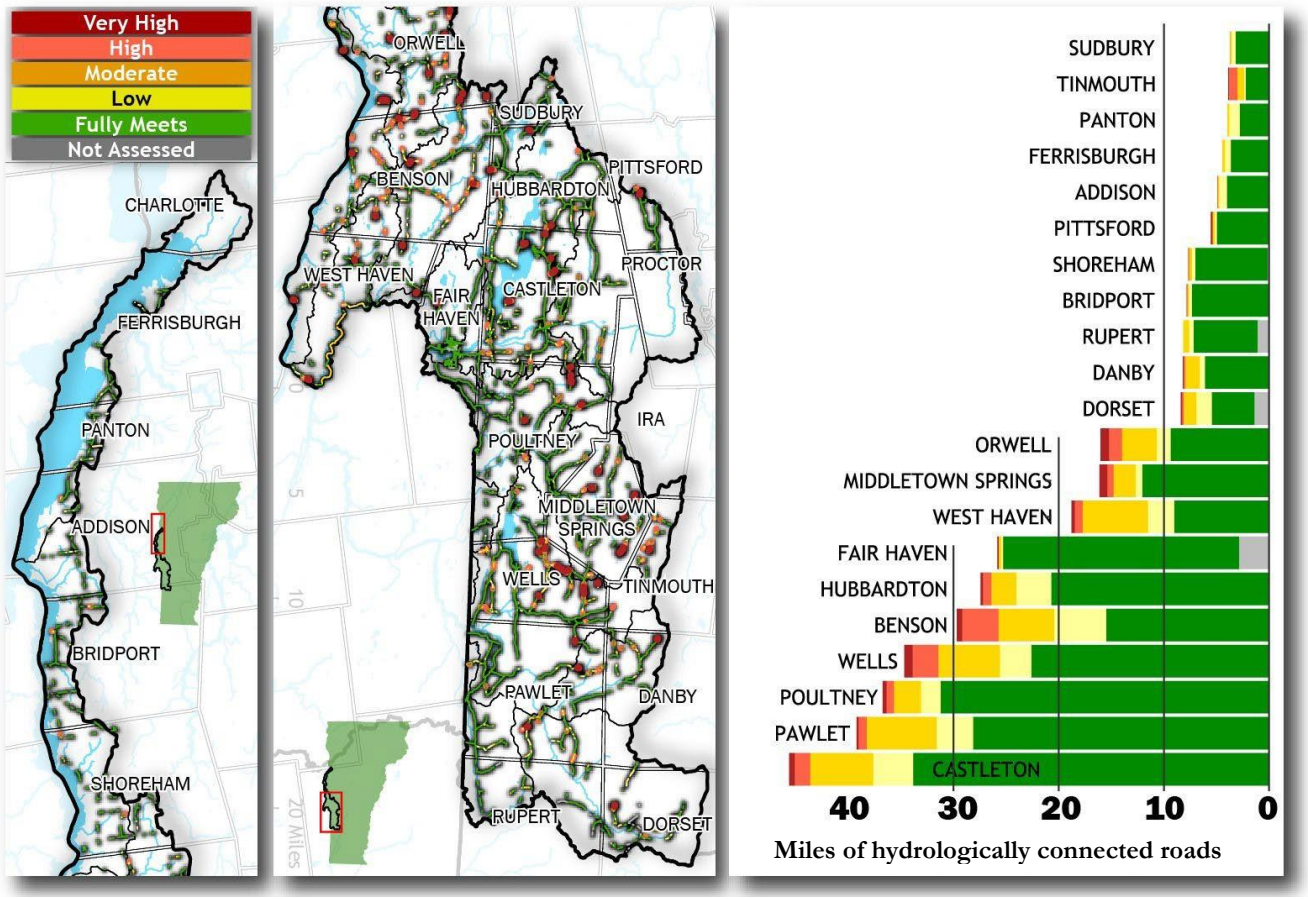


Figure 22. Basin 2 & 4 road segment priorities based on REI status as part of the Municipal Road General Permit.

Castleton, Pawlet, Poultney, Wells, Benson, Hubbardton, Middletown Springs, Orwell, and Tinmouth are priority towns for funding because they have the highest number of non-compliant roads to be improved to reach 15% by 12/31/2022. Priority for funding road improvements should also be targeted in towns with high phosphorus loads from non-VTrans roads (e.g., Benson, Castleton, Orwell, Poultney, West Haven), lake watersheds with increasing nutrient trends, such as Lake Bomoseen and Lake Hortonia, and priority road related projects identified in SWMPs and LWAPs.

VTrans Municipal Grants in Aid & Vermont Local Roads

The VTrans Municipal Grants In Aid Program provides technical support and grant funding to municipalities to promote the use of erosion control and maintenance techniques that save money while ensuring best management practices are completed in accordance with the VDEC's MRGP. The Vermont Local Roads team helps municipal highway departments and town governments to improve their road networks by providing training, technical assistance, communication tools and information exchange. These programs help implement the strategies described here and listed in Chapter 5.

Transportation Separate Storm Sewer System General Permit – TS4

The Transportation Separate Storm Sewer System (TS4) General Permit covers stormwater discharges from all Vermont Agency of Transportation (VTrans) owned or controlled impervious surfaces. The TS4 general permit combines the stormwater requirements for VTrans associated with its designated regulated small municipal separate storm sewer systems (MS4s); industrial activities, commonly regulated under the Multi-Sector General Permit (MSGP); and previously permitted, new, redeveloped, and expanded impervious surface, commonly regulated under State Operational Stormwater permits.

As required by the permit, VTrans has an approved Phosphorus Control Plan (PCP) that achieves on average 25% of the total reduction to Lake Champlain in each 4-year period. Projects on VTrans roads, rights-of-way, and facilities in Basin 2 & 4 will be prioritized to include highly hydrologically connected road segments, existing road drainage deficiency, or localized erosion.

The PCP meets the requirements of the Lake Champlain Phosphorus TMDL and will result in the reduction of phosphorus loading from roads, rights-of-way, and facilities under the Agency's control by over 20% within the next 20 years (by June 17, 2036).

A VTrans Lake Champlain Basin Phosphorus Control Plan Story Map outlines the agency's process towards developing the PCP and this VTrans factsheet provides additional information.

Vermont Road and Bridge Standards

In addition to the MRGP, towns can voluntarily adopt the 2019 Vermont Road and Bridge Standards (VRBS). These standards are administered by VTrans and go above and beyond MRGP standards. For example, municipalities may adopt MRGP standards for non- hydrologically connected roads. Towns adopting the Vermont Road and Bridge Standards may be entitled to higher cost share rates in federally declared flood event reimbursements. Dorset and Rupert are priority towns identified for adoption of the 2019 VRBS.

Managing for road runoff in the upper catchments will lessen the pressure on the areas receiving larger contributions of runoff. Waters being impaired lower in the watershed does not negate the need for action high up in the watershed. Lack of good management in the headwaters can often be the cause of water quality issues further downstream because of cumulative impacts. For this reason, road BMPs for water quality are recommended basin wide and on steep slopes.

Equipment Grant and Sharing Programs

The VDEC Small Equipment grant, administered by an outside grantee (Northwest RPC in SFY 2021), has smaller hydroseeders to be used by individual towns (not shared) available on the rotational basin schedule. Each year, towns in different parts of the state will be given the opportunity to access funding to purchase equipment that can assist the municipality in implementing required MRGP practices. Match may be required. Equipment includes hydroseeders, hay bale shredders, rolling and plate compactors, road shoulder discs, ditch stone screener, and leaf blowers. The VDEC MRGP program supports as many towns as possible buying into the regional seeder or purchasing their own. There is no longer funding for additional regional hydroseeders, but

the PMNRCD has a hydroseeder that is managed by the Town of Castleton and can be shared with towns in the basin. For this program to continue to be successful, funds are needed for outreach and training to get municipalities on board with using the shared equipment. A strategy for this need is found in the Implementation Table in Chapter 5.

C. Wastewater

Wastewater Treatment Facilities (WWTF)

Most municipal wastewater, originating from a combination of domestic, commercial, and industrial activities, is conveyed to centralized wastewater treatment facilities (WWTF), and treated to established standards identified in permits before discharge into a receiving water. There are six municipal facilities that are subject to National Pollutant Discharge Elimination System (NPDES) discharge permits in the basin (Table 17). All these facilities were issued new permits effective on July 1, 2019, with an expiration date of June 30, 2024.

An overarching consideration for the issuance of permits in the Basin 2 & 4 planning basin is the Lake Champlain Total Maximum Daily Load (LC TMDL) for phosphorus. As of the issuance of this Plan, all Basin 2 & 4 Waste Treatment Facilities (WWTFs) ultimately discharging to Lake Champlain must, collectively, discharge no more than 1,851 kg of total phosphorus per year. The 2016 LC TMDL did not alter the allowable phosphorus discharge loads from WWTFs that discharge to South Lake A or B or Port Henry segments, and as such, no specific requirements for upgrade are addressed by this plan. This does not eliminate requirements for ongoing operation and maintenance of these facilities, nor scheduled engineering performance reviews required of all WWTF in Vermont. The municipal wastewater discharge permits in place in the basin are shown in Table 17.

To meet statutory requirements, the WSMD, with assistance from certain municipalities, is conducting an extensive sampling effort to document the current loading conditions to determine the "reasonable potential" that WWTFs have, to cause or contribute to downstream water quality impairment. Results of these investigations are recorded as part of permit issuance documentation, which can be viewed on the Wastewater Program's discharge permit database.

Each of the public facilities received a reasonable potential determination (RPD). Based on this analysis, the Secretary determined that the available data indicated that the discharges do not cause or have a reasonable potential to cause or contribute to instream toxic impacts or instream excursion above the water quality criteria. As such, other than the effluent limitation for phosphorus, the development of Water Quality-based Effluent Limitations (WQBELs) was not necessary.

Table 18. Basin 2 & 4 wastewater treatment facilities subject to NPDES Direct Discharge Permits. MGD = Millions of gallons per day.

Facility (Permit ID)	Permit effective date	Permit expiration date	Permitted flow (MGD)	Current percent of flow design*	TMDL WLA** (kg P/yr)	Treatment type	Receiving water
Benson 3-1166	7/1/2019	6/30/2024	0.0177	68%	122	Aerated Lagoon	Unnamed Trib. to Hubbardton River
Castleton 3-1238	7/1/2019	6/30/2024	0.480	71%	397	Sequential Biological Reactor	Castleton River
Fair Haven 3-1307	7/1/2019	6/30/2024	0.500	31%	414	Oxidation Ditch	Castleton River
Orwell 3-1214	7/1/2019	6/30/2024	0.033	70%	228	Aerated Lagoon	South Fork of East Creek
Pawlet 3-1220	7/1/2019	6/30/2024	0.040	25%	276	Rotating Biological Contactor	Indian River
Poultney 3-1231	7/1/2019	6/30/2024	0.500	62%	414	Sequencing Biological Reactor	Poultney River

** Percentage was calculated using the average monthly flows (Effluent Gross Value) for the period 5/1/2021 to 5/1/2022.*

***The TMDL Waste Load Allocation (WLA) is the same as the current permitted load (kg P/yr).*

Facility Specific Information

Benson

The Town of Benson operates an aerated lagoon facility (one primary and one secondary) that provides secondary treatment and chlorine disinfection of municipal wastewater that discharges to an unnamed tributary to the Hubbardton River.

Castleton

The Town of Castleton operates a municipal wastewater treatment facility that provides secondary treatment employing a sequential batch reactor process followed by ultraviolet disinfection that discharges to the Castleton River. Based on the December 2020 Preliminary Engineering Report, the facility is adding a new rotary screen with 0.25" openings at the headworks and otherwise refurbishing the SBRs and UV disinfection systems. The hydraulic capacity of the equipment (0.540 MGD) exceeds the permitted hydraulic capacity (0.325 MGD). This project is currently under construction.

Town of Castleton municipal sewer service is currently available on the east shore of Lake Bomoseen, including Bomoseen Village and extending as far north as the Crystal Beach/Crystal Haven area. An engineering facilities plan (Aldrich & Elliot, 2013) for the east shore of Lake Bomoseen recommends extension of sewer service to Crystal Heights, an existing suburban style street of about 14 homes. This street is located near Crystal Beach, but higher and further away from

the lake, on the east side of Route 30. The facilities plan also addresses the Floating Bridge Road area at the north end of Lake Bomoseen, in Castleton, but it does not recommend sewer extension to that area, because of high cost.

The west shore of Lake Bomoseen currently lacks municipal sewer service. The engineering feasibility study report discusses options for sewer service for the west shore and does not recommend a municipal sewer extension on the west shore, because of high cost. Municipal sewer service now extends only to Hydeville, at the south end of the lake. The feasibility report also addresses cluster options for decentralized wastewater treatment, but ultimately recommends a "homeowner awareness" (a.k.a. "best fit") model, because of shallow ledge, shallow groundwater, setback distances, etc. The Kehoe State Conservation Camp already has an onsite system on the best soils for wastewater treatment on the west shore. An engineering evaluation was 90% complete as of the latest inspection in January 2022.

Castleton has started planning for a Main Street wastewater project, but the project is currently on hold.

Fair Haven

The Town of Fair Haven operates a wastewater treatment facility utilizing an oxidation ditch. The secondary treated wastewater is disinfected using chlorine, dechlorinated, and discharged to the Castleton River. In 2000, the facility was upgraded to include phosphorus removal. The facility is nearing the end of an upgrade begun in September 2021 to install aeration tanks to replace the oxidation ditch. It is expected to be completed in late summer of 2022.

Fair Haven started planning for a River Street Project. The sewer collection system planning study will focus on the south end of Town in River Street, east of the river. The intent of the study is to summarize and review the River Street and Adams Street pump station run times, perform sewer manhole inspections to document the condition of the collection system, to identify locations for night-time flow gauging and flow metering, and to gather info on manhole deficiencies. The project study will document the existing stormwater collection system in this study area. Night-time flow gauging efforts will be performed to assess the infiltration rates of pipe segments. Inspections and inventory of sump pumps within the River Street pump station collection system will be completed. The project will also evaluate the need for sewer system rehabilitation and/or new stormwater collection systems on River Street.

Orwell

The Town of Orwell operates an aerated lagoon that provides secondary treatment and chlorine disinfection of municipal wastewater that discharges to the South Fork of East Creek.

Pawlet

The Town of Pawlet operates a wastewater treatment facility that employs a rotating biological

contact system. Secondary treatment wastewater is disinfected using ultraviolet light and discharged to the Indian River. Wastewater enters a parallel series of two septic tanks, passes through a series of four aerated equalization tanks and onto the RBC unit. Wastewater then enters the clarifier, is disinfected in the disinfection chamber, and is discharged.

Poultney

The Village of Poultney operates a wastewater treatment facility that receives residential and commercial wastewater from the Village of Poultney. The system includes sequential batch reactors with phosphorus removal and disinfection using ultraviolet light that discharges to the Poultney River.

Septic Systems

The State of Vermont adopted, on July 1, 2007, universal jurisdiction over the design, permitting, and installation of all new wastewater systems and potable water supplies including septic systems. All new wastewater systems and potable water supplies need to obtain a Wastewater System and Potable Water Supply Permit for activities such as:

- subdivision of land;
- construction of a new building that needs a wastewater system (often referred to as sewage disposal or a septic system) or water supply;
- repair and/or replacement of a failed wastewater system or water supply; and
- when there is an existing wastewater system and/or potable water supply but there will be an increase in water or wastewater design flows due to either a modification to, or a change in use of, a connected building.

Systems installed before July 1, 2007, and systems installed or receiving increased flows after 2007 that did not receive a permit could potentially discharge into surface waters if the system was not installed correctly and is near a river, lake, or wetland. Failed systems that discharge pollutants into surface waters are difficult to identify without landowner permission and there is no current regulatory tool that requires inspections of pre- or post-2007 wastewater systems on a regular basis unless specified in their permit. If a citizen observes signs of a failed septic system, they should contact their Town Health Officer. There are programs that provide financial assistance to qualifying homeowners that need to upgrade their systems, but costly upgrades prevent many homeowners from upgrading their systems. Beginning in SFY 2022, American Rescue Plan Act (ARPA) funds that may benefit municipalities and residents in the basin for wastewater focused actions were made available. This includes funding directed to ANR for:

- Reducing sewer overflows;
- Improving water and sewer infrastructure in mobile home parks and providing financial assistance to low-income homeowners with failed on-site water and wastewater systems; and,
- Developing community sewer systems in some of the more than 200 villages that currently lack such systems.

Momentum has been gaining in rural villages to explore options to deal with concerns about pollution from septic systems and growth in village centers that result in a need for centralized shared wastewater systems. A demonstration project in the town of Warren, Vermont, was reported to the US EPA as a different approach for managing wastewater in rural villages (Stone Environmental, Inc., 2005). Areas with concentrated development along shorelines and streambanks with systems installed before July 1, 2007, are a priority for assessment. Ferrisburgh is exploring opportunities to improve wastewater infrastructure. Addison Four Corners completed construction of a community wastewater disposal system serving municipal buildings and the church.

Wastewater Workshops (formerly Septic Socials)

Concerns around failing septic systems is especially important in lakeshore communities. Many camps along lakeshores were built before July 1, 2007, and many of the camps were built for seasonal occupancy. If a lake is experiencing an increase in nutrients or *E. coli*, it is often difficult to pinpoint the exact sources. Septic systems could be a source.

One way to get people informed about the health of their systems is to host a wastewater workshop. Wastewater workshops are neighborhood gatherings where homeowners learn about the options for a well-functioning septic system and good maintenance practices, including household products that are kind to septic systems. The event provides an informal opportunity for people who may never have seen a septic system to learn about them. The host discusses the importance of water quality protection and then a septic system specialist discusses operation and maintenance of septic systems using the host homeowner's system as the demonstration model. Attendees are provided with brochures and other resource materials. The workshops are best for areas with old septic systems that may be having an impact on water quality. These places are often around lakes with old camps or buildings built for seasonal use that are now seeing more activity year-round. Wastewater workshops can also be held in riverbank communities. Areas in Basin 2 & 4 that would benefit from wastewater workshops are all the larger populated lakes including Lake Bomoseen and Lake St. Catherine, but other interested lake communities are encouraged to participate. More information can be found on the Wastewater Workshop website.

D. Natural Resources

Forests, lakes, ponds, rivers, floodplains, and wetlands are all examples of natural systems that provide continuing benefits both socially and ecologically. Natural resource restoration projects help to prevent and reduce nutrient and sediment pollution, improve flood resiliency by mitigating flood hazards, enhance habitat function, and support Vermont's outdoor recreational opportunities. These projects are also the most economical and have a long-term benefit with little to no maintenance requirements. Restoration and protection of natural systems offer a cost-effective, long-term means to mitigate water quality and the effects of climate change and enhances the ecosystem services - flood control, wildlife habitat, filtration of pollutants - these natural resources provide.

Although Agency regulatory programs protect natural resources, the following sections focus on the Agency's work to support landowner interest in natural resource restoration. Over the next five years, the agency will depend on partners to provide some of this assistance.

Rivers

In response to historic intensive channel management, floodplain and riparian corridor encroachments, and watershed land use change, most Vermont rivers are actively adjusting their shape, size, and course as they seek to re-establish equilibrium (i.e., balance). Human activities can prevent or disrupt this balance by changing flow inputs to the channel (e.g., deforestation, increasing impervious surfaces and runoff, or water withdrawals) or by changing the sediment regime (e.g., dams, dredging). In Basin 2 & 4, legacy and present-day impacts, such as development within river corridors, channel straightening, dredging, berming, damming, removal of riparian vegetation and instream wood structure, and construction of undersized transportation structures, have contributed to stream instability. A key consequence of these activities is the loss of the resilience and ecosystem services provided by fully functioning rivers.

This section includes basin specific information on how to restore river function by improving longitudinal, lateral, vertical, and temporal connectivity. This supports good water quality, healthy aquatic habitat, and flood resilience in the basin and will help to mitigate impacts of increased runoff and streamflow described in the Climate Change section. Tactical basin planning engages local, regional, and federal partners in the development of strategies needed to accelerate practices to increase river connectivity and meet the state's clean water goals. The following details information about river corridor plans (RCP) and planting projects, strategic wood additions, Aquatic Organism Passage (AOP) restoration, and community efforts to regulate floodplain and river corridor development, which together guide project implementation in the basin to increase river connectivity.

River Corridor Plans

An RCP is a synthesis of the physical data collected during Phase I and II SGAs based on protocols and guidelines developed by the Vermont River Management Program. These plans identify causes of channel instability and make recommendations for restoration. All SGAs and RCPs can be found at the SGA – Final Reports website. While overall water quality in Basin 2 & 4 is satisfactory, the degraded geomorphic condition (Figure 8) of the basin's streams may impact:

- wildlife and fish habitat (e.g., riparian buffer removal that reduces shading and habitat for insects that feed fish, and channel alteration that destroys aquatic habitat).
- public safety (e.g., loss of floodplains that store floodwaters, accelerated streambank erosion which results in infrastructure damage, and channel straightening that increases flow velocity during rain events).
- water quality (e.g., higher phosphorus loading from bank soil erosion stormwater runoff from encroachment of impervious surfaces and agricultural land).

Where funding, local support, and interest exists, priority projects and objectives identified in these plans should be pursued in the Castleton River, Mettowee River, Poultney-Hubbardton River, Poultney River tributaries, and East Creek watersheds. Specifically, this plan recommends local partners work with consultants to review the Phase 2 SGAs to facilitate project development under Act 76 in the next five years. An ongoing project is reassessing the Phase 2 SGAs in the Flower Brook watershed and will use these data to inform the Functioning Floodplain Initiative (FFI) tool. Once developed, priority projects supported by the FFI tool and selected by BWQCs could be implemented using Water Quality Restoration Formula Grant funding or other funding sources.

River Restoration and Conservation

Active river restoration activities include the reconnection of floodplains through berm removal, woody buffer plantings, and bank stabilization techniques with biological materials. Scientific research strongly supports the value of planting trees and shrubs along river and lake shorelines for both water quality and wildlife habitat (Figure 23). Shoreline vegetation filters and cleans dirty runoff from uphill land uses, provides shoreland and shallow water habitat, stabilizes

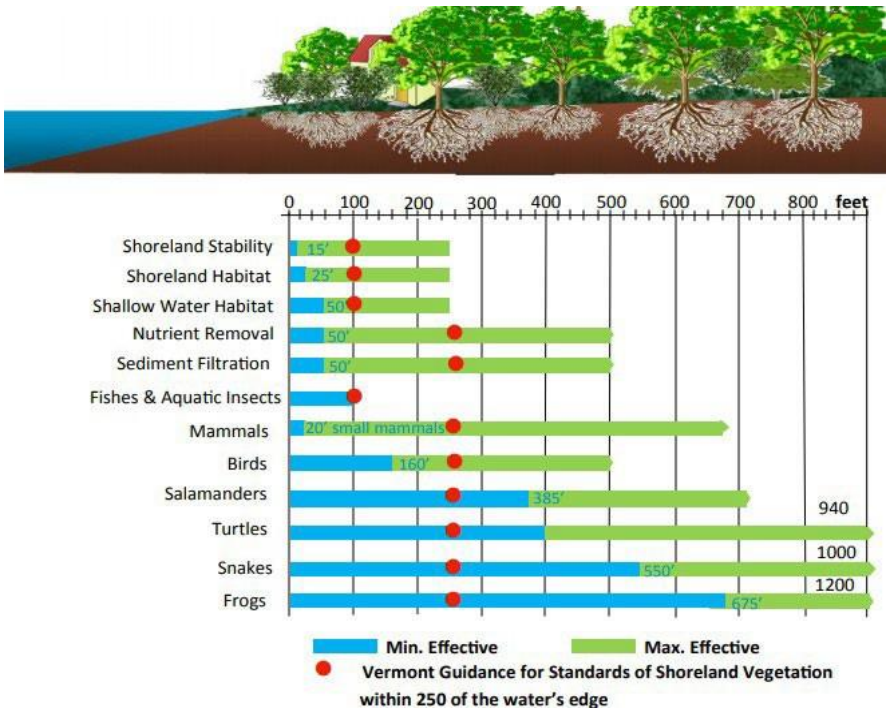


Figure 23. Recommended widths of shoreline vegetation for protection.

banks, and increases lake and river aesthetics. New research also indicates that streams in the lower, flatter reaches of the watershed are more likely to release carbon dioxide as a biproduct of ecosystem respiration when temperatures in streams rise compared to streams in steep watersheds (Jankowski & Schindler, 2019). Reducing soil erosion to streams by capturing stormwater, stabilizing soils, and increasing riparian buffers on low elevation streams may help to mitigate temperature increases and their impact on the carbon cycle.

Most riparian area planting projects are coordinated and carried out by the PMNRCD, USFWS, FWD, NRCS, and VAAFM in Basin 2 & 4. From SFY 2017 to 2020, 12,967 linear feet and 125.93 acres of riparian corridor buffer were planted/restored in the basin using state funds. From 2018 to 2021, PMNRCD planted ≈ 9,8000 stems in riparian buffers in the basin. These plantings were funded by Pur Projet (a private foundation), Trees for Streams, 350VT, and USFWS. Large scale plantings were completed in the Flower Brook watershed, along the Indian River, and on Lewis Brook. Smaller scale plantings were completed along tributaries of the Mettowee and Poultney Rivers.

In addition, the ANR prioritizes river reaches that are identified as high priority sediment and nutrient storage area for conservation. One option for protection, outside of land acquisition, is purchasing river corridor easements to avoid future encroachment, restrict channelization, and create a woody buffer that moves with the channel. River Corridor Easements protect rivers from channel management that can degrade the functions of a river corridor.

Strategic Wood Addition to Rivers and Streams

Large woody material is a critical component of rivers. It improves fish habitat, stream stability, floodplain connection, nutrient processing, and sediment storage, but it is generally lacking in most Vermont streams due to past and present river management practices to accommodate land uses such as: logging, agriculture, and urban and residential development. In 2022, wood jams were strategically added to 1-mile of stream on two tributaries of the Hubbardton River as part of a restoration project on The Nature Conservancy's (TNC) Hubbardton River Clayplain Preserve in West Haven. (Figure 24). The addition of the wood jams will slow flows, resulting in the storage of water, sediments and phosphorus on-site, thereby reducing downstream flooding and phosphorus loading, and improving

Figure 24. Hubbardton River Clayplain Preserve Project--Beaver dam analogues impounding sediment laden flow after a rain event (7/18/22). Photo credit: Shayne Jaquith, TNC.

on-site floodplain and wetland habitat. The wood jams will also accelerate the natural processes that restore river-floodplain connection.

No strategic wood additions priorities have been identified for the basin, but TNC, TU, the VT Rivers Program, FWD, and the WPP are discussing a workshop in the near-term to identify potential projects. In addition, when projects are proposed that improve both water quality and habitat and are supported by both FWD and the Rivers Program, funding will be prioritized. Training and workshops on assessment and implementation of this work will grow the knowledge base needed to increase implementation.

Dams

There are records of 49 dams of different types, sizes, and condition in Basin 2 & 4. While dams are used to generate energy and recreational opportunities such as boating, fishing, and swimming, they can also impede a stream's ability to transport flow and sediment; cause streambank erosion and flooding problems; degrade and alter fisheries habitat; create barriers to fish movement and migration; alter downstream temperature; degrade water quality; and impede river-based recreational activity.

Of the 49 inventoried dams, 41 are in-service, three are fully breached, one has been removed, and five are rated as significant hazards. The 41 active, in-service dams may constrict the stream channel enough to reduce sediment transport, prevent lateral movement, and inhibit aquatic organism passage (AOP) if mitigating actions have not been taken (e.g., fish ladder). Four of the five significant hazard dams are privately owned and one is owned by the State. The privately owned dams may be potential removal candidates, but will require landowner support and a site visit to assess local conditions. Additional dam information can be found in Appendix A.

On January 18, 2018, H.554 or Act 161, the Dam Safety bill, passed the Vermont House of Representatives and received final approval on May 10th of the same year. The bill was developed collaboratively with the VDEC, Vermont Natural Resources Council, Vermont Trout Unlimited, the Vermont Section of the American Society of Civil Engineers, and other partners. The bill gave the VDEC rulemaking authority which will update the regulation of dams in the State.

Dam removals are pursued by private and public dam owners, often with the help of watershed groups and partners. The Vermont Dam Task Force is an interdisciplinary team of natural resource professionals that collaborate to share and investigate current dam removal protocols, watershed science, funding, and dam removal opportunities. The group meets bi-monthly to collaborate on projects. The WID Watershed Planning Program coordinates with the Dam Task Force, the Vermont Rivers Program, the Vermont Dam Safety Program, and watershed partners to identify, prioritize, and find funding for dam removals throughout the state. Recently, with an uptick in funding, several organizations are also developing expertise in dam removal. These include TNC, the Lake Champlain Basin Program, and the Vermont River Conservancy.

There are several other ongoing or planned dam removals in the basin. A recent collaboration resulted in the removal of the Pelletier Dam in Castleton on the North Breton Brook. The dam was

owned by the VT Fish and Wildlife Department (FWD) and was removed in the Summer of 2022. The project removed approximately 15,000 cubic yards of sediments containing phosphorus, which also benefitted the Castleton River and ultimately, Lake Champlain. The project restored 36 miles of native trout habitat and improved water quality, stream stability, and flood resiliency. Funding for the removal was made available by the Lake Champlain Basin Program, New England Interstate Water Pollution Control Commission, the PMNRCD with volunteers, TNC, and WID also allocated funds from the Dam Removal Block Grant 2022 FY funds. The Vermont Natural Resources Council was the project manager for its removal. The engineering firm that planned the removal was Stone Environmental.

Another dam removal project is underway and PMNRCD is working with multiple partners including the US Forest Service (USFS), US Fish and Wildlife Service (USFWS), the Natural Resources Conservation Service (NRCS), and VDEC to remove six barriers to fish passage from the Mettowee River in Dorset, Vermont. The project was initially a landscape restoration partnership project, sponsored jointly through the USFS and NRCS, and grew to include many local, state, and federal partner organizations.

PMNRCD is providing outreach to ensure participation in the project and with landowners implementing practices to enhance habitat connectivity in the Mettowee River headwaters. The partners and landowners are working to improve water quality in the Poultney-Mettowee watershed and Lake Champlain; restore riparian function and processes; and reconnect and enhance aquatic habitats while improving flood resiliency. The practices include removing dams and other barriers that impede fish migration into the cooler headwater streams during the warm summer months and during spawning season.

In past years, two undersized culverts were replaced with longer bridges, which allowed for fish migration, other wildlife passage, and improved flood safety in the area. In the Summer of 2022, the partners are working with local contractors to remove three additional dams located in Dorset Hollow. Next year the partnership plans to remove a final barrier, opening the entire Mettowee River as a travel and habitat corridor for fish and other wildlife.

Other dams identified for removal include: the K.W. dam on the Mettowee River, Austin Pond Dam on Lake Bomoseen in Hubbardton, and several dams on Pond Hill Brook. The K.W. dam will be removed in 2022. The Sugar House Lane dam/bridge will be replaced with a bridge in 2023.

Dam removal is a priority basin wide where the removal will result in restoration of stream equilibrium and habitat, fish passage, and sediment reduction. Dam owners are encouraged to contact the Vermont Dam Safety Program and their Watershed Planner if they are interested in discussing dam removal. Additional resources are available from VDEC online and TNC also hosts a Dam Screening Tool which provides information for dams in the basin and additional details on each dam's ecological impact.

Transportation Infrastructure and Rivers

Also related to the health of rivers and streams is the infrastructure – bridges and culverts – built to relay the flow of water under transportation corridors. Transportation corridors include state, local, and private roads, large interstates, logging roads, private driveways, and railroads. Most of this infrastructure was built before engineers and scientists fully understood the balance required for managing sediment and flow to protect stream channels (and adjacent developed lands).

The correct sizing and placement of bridges and culverts plays a significant role in protecting water quality in the basin. Correctly sized structures prevent erosion and scouring upstream and downstream, allow for the passage of fish and wildlife, and reduce impacts from flooding. Correct placement of structures allows fish to move seasonally and to spawning territories. Without access to essential habitat, fish diversity and abundance decline.

The FWD have completed ANR Bridge and Culvert assessments of most culverts in Basin 2 & 4. The ANR developed a bridge and culvert assessment and screening tool to identify infrastructure in need of replacement or retrofit to restore AOP or address geomorphic issues. In addition, a guide for Implementing AOP Enhancement Projects in Vermont (Kirn, 2016) is available, and a culvert mapping tool has been developed by the WSMD MAP assessment program.

When culverts and bridges are built outside of the floodplain and river corridors, and sized correctly, they are more likely to weather a flood event. This underscores the importance of local zoning and bylaws to discourage new encroachments into floodplain and river corridors.

Oversight on culvert and bridge replacements includes standards for correct sizing to pass high water and debris, this reduces the probability of damage to infrastructure from future flood events. Implementation and support of Hazard Mitigation Plans, basin wide, will proactively protect infrastructure while also protecting floodplains, rivers, and streams. Floodplain restoration and expansion will also alleviate pressure on developed areas adjacent to surface waters in villages and town centers. Reducing streambank erosion and lessening flooding extent of developed areas by increasing floodplain connectivity will reduce phosphorus loading and the introduction of other pollutants into surface waters.

Local Zoning and Bylaws

Local bylaws and municipal plan policies can provide community specific protections and guidance to maintain and enhance local water resources. Local protections also afford benefits to downstream communities and water resource users. The RPCs provide water quality protection information for each municipality in the basin. The information helps to populate this section of the plan and the priority strategies related to rivers in the Chapter 5 Implementation Table. Although a community may have bylaws or town plan policies, it does not mean their resources are afforded the strongest protection. Communities may work with their RPCs to identify opportunities that provide their constituents with the highest level of natural resource protection within their means. Municipalities with high development pressure, significant impervious surface cover including roads, and significant development within proximity to water resources are a high priority for protection, as well as areas with deficiencies related to their protective policies, zoning,

or bylaws. These municipal protections provide myriad values:

- Local stormwater regulations prevent runoff of pollutants from hard surfaces into wetlands, rivers, and lakes. Stormwater management also slows flow into waterbodies during some flood events. Good examples of local regulations exist for Stowe, Manchester, and South Burlington.
- Smart planning and design for development through Local Hazard Mitigation Plans (LHMP) and ERAF attainment in towns and villages saves money and lowers the risk of significant loss during flood events, while protecting water quality as an added benefit.
- Limiting development on steep slopes, ridgelines, and landslide hazard areas can protect high quality water resources and prevent excessive erosion and sedimentation to streams and lakes that impacts water quality and aquatic habitat.
- Protecting river corridors helps protect roads and structures from erosive damage, improves water quality, moderates flooding, and enhances wildlife habitat. River corridor protection limits development close to stream and river channels to allow the channel to establish and maintain a least-erosive path through the valley lessening the need to armor channel edges.
    - In recognition of historic settlement patterns, the VDEC model river corridor protection bylaw (http://bit.ly/model-regulations) provides for infill and redevelopment in designated centers and densely developed areas provided that new development does not further encroach on the river relative to pre-existing development.
    - Floodplains function in part to allow excessive water to spread out and slow down. This reduces water depth and power and allows sediment, including phosphorus, to deposit. The VDEC model bylaws use no adverse impact standards that are consistent with statewide flood resilience goals and will reduce impacts to public safety, infrastructure, and water quality from flooding.
- Adding or improving zoning increases protections for wetlands and may include: no fill in any wetlands, increasing buffer widths, installing fencing and landscaping around the outer perimeter of the wetland buffers, restricted infrastructure encroachment standards, etc. Examples of other protections towns incorporate into local zoning for wetlands and additional resources are available from the VDEC Wetlands Program.

FEMA Mapping Updates

Federal Emergency Management Agency (FEMA) is currently updating the Flood Insurance Rate Maps (FIRMs) in Vermont for the National Flood Insurance Program (NFIP). This will be the first map update for many towns since the 1970s or 1980s. Some Vermont counties received official "digital" FIRMs in 2007, but most of the flood hazard areas did not get fresh studies. This new update will cover the entire state in stages and may become effective in some counties as soon as 2024 as part of FEMA's Risk Mapping, Assessment, and Planning (Risk MAP) program. Towns will receive a notice from FEMA of an initial discovery meeting. During the meeting, stakeholders, including FEMA, state, and community officials, will discuss areas of flooding concern and project goals, milestones, and products. Flooding sources will be considered during this meeting and will

likely include major rivers such as the Castleton River, the Poultney River, and the Mettowee River.

Updated FIRM maps will identify the high-risk flood hazard areas in the basin that are the focus of municipal flood regulations. Most of the area will have much improved computer-model based Zone A hazard information using updated flood discharge data and one-foot contours. Some reaches will have older studies aligned with current topography. A few areas may be prioritized for updated field-based studies incorporating data from bridges and other obstructions.

The effective date for the new maps is not likely until 2025 or later. Current FIRMs for communities in the basin are posted at www.msc.fema.gov.

VDEC Hazard Area Bylaws and ERAF

VDEC River Corridor and Floodplain Protection Program has prepared model flood hazard bylaws (bit.ly/model-regulations) to assist municipalities in the development of their flood hazard regulations. These bylaws have been pre-reviewed by FEMA and meet or exceed the requirements of the NFIP. In addition, adoption and enforcement of Section D, River Corridors, qualifies communities for enhanced cost share under the Emergency Relief and Assistance Fund (ERAF).

ERAF provides State funding to match Federal Public Assistance after federally declared disasters. Eligible public costs are reimbursed by federal taxpayers at 75%. As of October 23, 2014, the State of Vermont contributes an additional 7.5% toward the costs. For communities that take specific steps to reduce flood damage the State will contribute 12.5% or 17.5% of the total cost. Towns that meet ERAF criteria protect water quality while protecting themselves financially. A summary of ERAF coverage is provided below and strategies for achieving coverage is in the Implementation Table in Chapter 5.

- As of July 8, 2022, three towns in Basin 2 & 4, Orwell, Pawlet, and West Rutland, qualified for the 17.5% contribution.
- The towns of Castleton and Pawlet are the only towns in the basin that have adopted municipal river corridor protection. Orwell, West Rutland, Rupert, and Dorset have interim protection under ERAF**.** These towns could lose their interim coverage if they do not adopt the municipal river protection.
- All towns have adopted the 2019 Town Road and Bridge Standards.
- All towns except Tinmouth are participating in the National Flood Insurance Program.
- Three towns Danby, Dorset, and Rupert do not have a Local Hazard Mitigation Plan.

In addition, the FY 2022 and FY 2023 budgets appropriate nearly $20 million of American Rescue Plan Act (ARPA) funds for mitigating flood hazards and supporting implementation of the State Hazard Mitigation Plan, including strategic buyouts. Questions regarding the model flood hazard bylaws and ERAF should be directed to the appropriate VDEC Regional Floodplain Manager: bit.ly/flood-manager.

Lakes

A lake's physical characteristics are driven by its watershed size, topography, geology, soil fertility and erodibility, and vegetation. A lake's water quality is impacted by activities, or the land use, on the immediate shoreland and further into the watershed. For example, the loss of native vegetation at the shoreline, the locations of roads, development pressures around the shoreline, along tributaries, and further into the watershed, and activities such as agriculture and forestry all contribute to overall lake and pond health. All these activities impact how water moves across the landscape and ultimately enters the lake.

The recommendations below were developed based on the VT Inland Lakes Scorecard status of lakes and ponds in Basin 2 & 4 and feedback from the Lakes and Ponds Management Program. More information about the VT Inland Lakes Scorecard and Basin 2 & 4 lakes and ponds is found in Condition of Lakes and Ponds section of Chapter 1 and Priorities for Surface Water Protection in Chapter 2.

Lake Watershed Action Plans

Lake Watershed Action Plans (LWAPs) are assessments to identify pollution sources in the lake watershed that are resulting in water quality and habitat degradation in the assessed lake. The LWAP results in a prioritized list of projects and strategies to address the sources of pollution and habitat degradation identified in the assessment. The plan may also contain recommendations to preserve natural features and functions, encourage use of low impact green stormwater infrastructure, and maintain the aesthetic and recreational uses of lakes. Lake St. Catherine is the only lake in Basin 2 & 4 that has completed a LWAP.

Spring total phosphorus (TP) concentrations are significantly increasing for Lake Hortonia, Austin Pond, and Hinkum Pond and summer TP concentrations are showing a significant increasing trend for Lake Bomoseen. To reverse or stop the trend and maintain the very high quality, Lake Bomoseen is listed as a high priority for an LWAP in this plan. It already has a SWMP and with an active Lake Association, it is a good candidate for a LWAP.

The only lake in the basin with an ongoing LWAP is Lake St. Catherine. Historically, the Lake St. Catherine Association has participated in numerous programs and assessments (e.g., Lay Monitoring, AIS control, Greeter Program, Lake Wise, and a SWMP) and is now completing an LWAP to identify water quality issues within the watershed and address them by implementing prioritized water quality projects. The LWAP projects will be entered into the VDEC Watershed Projects Database and will be a priority for CWIP funding and funding from other sources.

Little Lake (Wells) have had ProcellaCOR (an aquatic herbicide) treatments to reduce the spread of Eurasian Water Milfoil, and one is being considered at Lake Bomoseen, so these lakes are prioritized for continued AIS monitoring and control. There are two lakes with no AIS management, Black Pond in Hubbardton and the Port Henry Section - Lake Champlain in Ferrisburgh. Black Pond is a priority for invasive species management and is included as a strategy in Ch. 5. Rapid response and control are appropriate in any lake where new AIS infestations emerge.

The Aquatic Nuisance Control (ANC) Grant-in-aid Program is offered by VDEC and provides financial assistance to municipalities and agencies of the state for aquatic invasive and nuisance species management programs. Funding for Grant-in-aid grants comes from a portion of annual revenues from motorboat registration fees and federal funds. This grant program has supported over 70 municipalities since 1994. PMNRCD is a regional partner and administers Aquatic Nuisance Control Grant-in-Aid (ANC GIA) funds for Lake Bomoseen, Echo Lake, and Lake Beebe. These three lakes are a priority for continued AIS management, capacity building, and funding and are included as a strategy in Ch. 5.

Protecting and Improving Shoreland Condition

Effective July 1, 2014, the Vermont Legislature passed the Shoreland Protection Act (Chapter 49A of Title 10, §1441 et seq.), which regulates shoreland development within 250 feet of a lake's mean water level for all lakes greater than 10 acres in size. The intent of the Act is to prevent degradation of water quality in lakes, preserve habitat and natural stability of shorelines, and maintain the economic benefits of lakes and their shorelands. The Act seeks to balance good shoreland management and shoreland development.

Shoreland developed prior to July 1, 2014, is not required to retroactively meet standards. Towns can also opt to delegate the permitting to their town to administer its own functionally equivalent shoreland standards, in which case a municipal permit is required.

In September 2022, the Vermont Lakes and Ponds Program released new guidance to help property owners protect and restore lakeshore properties. The Shoreland Best Management Practices guidance is comprised of multiple Best Management Practice documents. Each document highlights different shoreland management activities to improve water quality and the health of lakeshore habitat. Examples of activities include planting native trees and shrubs, installing rain gardens to absorb runoff, improving driveways and pathways, and creating no-mow zones.

The Lake Wise Program, an Agency of Natural Resources initiative that awards lake-friendly shoreland property, including that of state parks, town beaches, private homes, and businesses, is available to lakeshore owners and Lake Associations to assess shoreland property for improvements that benefit water quality and wildlife habitat. Lakes with a fair shoreland score will benefit from implementing Lake Wise Program best management practices. More information on the program can be found at: http://dec.vermont.gov/watershed/lakes-ponds/lakeshores-lake-wise/what.

Six lakes in Basin 2 & 4 were identified as priorities for Lake Wise: Little Lake, Beebe Pond, Lake

Hortonia, Burr Pond, and Sunrise and Sunset Lakes based on their water quality status and shoreland scores. Nineteen other lakes have a fair shoreland rating. If communities in any of these fair rated shorelands are interested in pursuing Lake Wise, they can contact the Lake Wise Program. Watershed partners are currently working with some of these lake communities and outreach will be planned for the additional lakes in the next five years.

Lake users interested in becoming involved in the health of their favorite lake or pond should use the Lake Score Card Checklist of Lake Protection Actions on the VDEC Lakes and Ponds website as a first step to moving toward a healthier lake or pond.

Wetlands

Wetlands cover about 8% of Basin 2 & 4 and are important for safeguarding the many high quality surface waters in the basin. As recently as the 1950s, wetlands were seen as obstacles to development, agriculture, and transportation, and consequently, were systematically drained and altered. These losses and alterations compromise the important ecosystem services provided by wetlands such as sediment and nutrient attenuation, wildlife habitat, and flood water storage. See the following for more information (Vermont's Return on Investment in Land Conservation | Trust for Public Land (tpl.org)). While protecting remaining wetland resources is an important strategy in the basin (see Ch. 2), restoring degraded wetlands is essential to improving water quality.

This section is organized around wetland conservation and restoration and identifying sites with the greatest potential for improving water quality.

Wetland Protection

The VT Wetlands Program plays in integral role in protecting the State's surface water through wetland regulatory, protection, and monitoring activities. The VT Wetlands Program uses existing but dated wetland mapping to help preliminarily identify the locations of some regulated wetlands (Class II and Class I). Updated wetland mapping is slated to be completed for the basin by 2026. Citizen scientists can help identify wetlands for mapping in the meantime by attending trainings on mapping. Watershed partners will help to share opportunities for trainings, as they are available, as part of a strategy in the Chapter 5 Implementation Table.

Additional protection through Class I wetland determination can be afforded to wetlands that have been determined to be exceptional or irreplaceable in their contribution to Vermont's natural heritage, based on their functions and values. In 2022, Ward Marsh was petitioned as a Class I Wetland by the Town of West Haven with support from the Rutland Regional Planning Commission, because of the exemplary and irreplaceable functions and values it provides on the landscape (Figure 25). The marsh is ~165 acres in West Haven, is partially owned/managed by the FWD and TNC, and extends onto adjacent private lands. One noteworthy function is that Ward Marsh is hydrologically connected to the Poultney River and regularly receives and stores flood waters thereby preventing downstream flood damage. The Wetlands Program has identified the wetlands north of Ward Marsh along the Poultney River for further study as having the potential for Class I designation. No additional wetland candidates have been proposed by the Vermont Wetlands

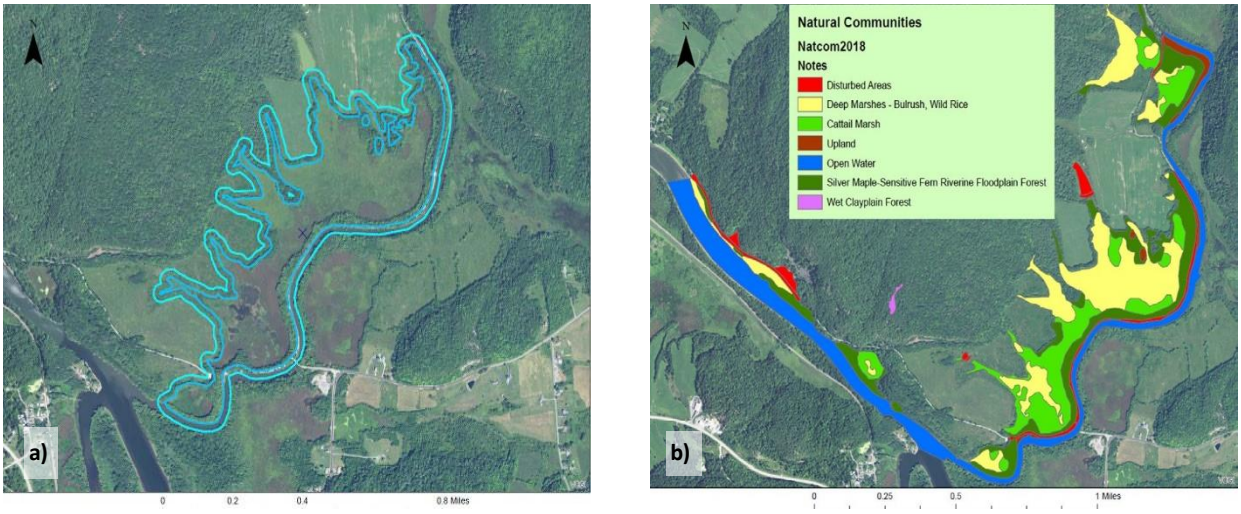


Figure 25. a) Ward Marsh mapping with 100-foot buffer delineated, b) Natural community mapping. Photo credit: Zapata Courage, DEC-Wetlands.

Program in the Basin 2 & 4. One wetland, the South Fork of East Creek in Benson and Orwell, has been identified for further study for Class I wetland designation. Stakeholders interested in wetland reclassification are encouraged to reach out to their basin planner and VT Wetlands Program staff for technical assistance. Watershed partners in the basin (Regional Planning Commissions and Natural Resource Conservation Districts) are also able to provide outreach and support to municipalities and private landowners interested in reclassification efforts. This plan recommends assessing interest for reclassification in the prioritized areas.

Wetland Restoration

Wetland restoration is the process of returning a degraded wetland to an approximation of its pre-disturbance condition. The United States has lost over half of its wetlands through ditching and filling since European colonization between 1780 and 1980, and Vermont has lost as much as 35 percent. While conservation and protection of wetlands are critical for preventing continued loss of our remaining intact wetlands, wetland restoration is essential for rehabilitating those that have already been degraded or lost. Clean water goals for wetland restoration include assessing an area of prior converted wetland and hydric soils for restoration and implementing restoration as sites and opportunities are identified. This plan recommends that wetland restoration and conservation be explored where water pollution reduction and flood protection is evident.

Recommendations for wetland restoration can be found in Stream Geomorphic Assessments and River Corridor Plans and the Vermont Regional Conservation Project Partnership (RCPP) Wetlands Project Outreach and Development maps created by Arrowwood Environmental. The South Lake Basin was identified as one of the priority watersheds for the RCPP project, so the map can be used to identify high priority areas for restoration. Moreover, prioritization of sites will be informed by the

Wetland Restoration Potential scores on the ANR Atlas. Field surveys are critical for ensuring accuracy as some wetlands may have been missed or misidentified. Watershed partners are encouraged to work on project development to restore previously drained and degraded wetlands along East Creek.

Forests

Forestlands cover approximately 56% of Basin 2 & 4 and are important for safeguarding many high-quality surface waters in the basin. Management activities take place on a portion of those lands for the benefits of maintaining healthy forest communities, improving wildlife habitat, addressing non-native invasive plants, contributing to the working landscape economy, and addressing poorly designed legacy road infrastructure. Improving management and oversight of harvesting activities can help reduce sediment, nutrients, petroleum products, and woody debris that can end up in surface waters if Acceptable Management Practices (AMPs) are not followed. Additionally, providing educational outreach and technical assistance to forest landowners and land managers and funding to implement improvement practices will grow the practice of good stewardship and water quality protection. As the dominant land cover type in the basin, reducing runoff and erosion from forests is important to meeting the state's clean water goals.

This section is organized around the Vermont Department of Forests, Parks and Recreation (FPR) Acceptable Management Practices for Logging Jobs, Vermont Voluntary Harvesting Guidelines to protect forest health and Sustainability, local skidder bridge programs, and forestland conservation efforts.

Forestry AMPs and Skidder Bridge Programs

Acceptable Management Practices (AMPs) for Maintaining Water Quality on Logging Jobs in Vermont were developed and adopted as rules by the FPR for Vermont's water quality statutes and became effective in 1987 and were subsequently revised effective August 11, 2018. The AMPs are intended and designed to prevent mud, petroleum products, and excessive woody debris (i.e., logging slash) from entering the waters of the State and to otherwise minimize the risks to water quality. The AMPs are scientifically proven methods for loggers and landowners to follow for maintaining water quality and minimizing erosion. The 2018 AMP manual can be downloaded from FPR's website.

The FPR provides portable temporary bridge rental opportunities for loggers during timber harvests. These bridges reduce the occurrence of sedimentation, channeling, and any degradation of aquatic habitat, while allowing loggers to harvest timber in compliance with State AMPs. When properly installed, used, and removed, portable temporary bridges minimize stream bank and stream bed disturbance as compared with alternative devices, such as culverts or poled fords. Portable bridges are also economical because they are reusable, easy to install, and can be transported from job to job. More information on the bridge rental program is found on the Temporary Bridge website.

In March 2018, the FPR held a temporary skidder bridge lottery, and 12 loggers and logging companies were chosen to receive bridges that were constructed by Fontaine Millworks in East Montpelier. The FPR will also be offering workshops for building bridges throughout the state.

Specifications for building skidder bridges can be found at: https://fpr.vermont.gov/skidder-bridges. These bridges should be utilized in areas of logging basin wide with a focus on steep slopes and areas with erodible soils adjacent to surface waters.

Use Value Appraisal Program & AMPs

There are 103,330 acres of forestland currently enrolled in the Use Value Appraisal program (UVA) in the basin. Compliance with Vermont's UVA requires that the AMPs be employed to the maximum practicable extent. If the AMPs are not employed on UVA enrolled forestland but no discharge occurs, it may affect UVA eligibility without presenting a water quality violation. However, if the AMPs are not employed to the maximum practicable extent on the UVA parcel resulting in a discharge, it may affect parcel eligibility in UVA and be a water quality violation. While there is overlap between requirements of the AMPs and UVA, they should be viewed as distinct from each other. In addition, Act 146 creates a new enrollment subcategory in the Managed Forestland category called 'Reserve Forestland,' with enrollments in the subcategory beginning July 1, 2023. This change to UVA accelerates the development of old forest conditions, and it does so in a way that preserves working lands as the primary focus of the Managed Forestland category of the UVA program. More information is available on the UVA Reserve Forestland website.

In the basin, Benson (8,675 acres), Poultney (7,303), Wells (6,939), Castleton (6,767), and Middletown Springs (5,006) have the largest area of forestlands that are not under the UVA program or managed by the state. These towns are priority for outreach and education for AMPs and the UVA program. In addition to programs like the AMPs and skidder bridge rentals, County Foresters are available for consultation when questions arise about practices to protect water quality.

Forest Road Assessments and Management

The ANR has developed a process and web application for assessing and prioritizing erosion issues along hydrologically connected forest roads. The next step is a state-wide ANR forest road assessment project that will take place over the next 3 years. State Forest roads in the basin are found in Lake St. Catherine State Park, Bomoseen State Park, and Half Moon Pond State Park.

It is expected that the ANR Road Erosion Inventory App, and application used to inventory and map road segments based on their condition for the Municipal Roads General Permit, will become a resource for contractors and volunteers on private land. Downloadable to smart phones and smart screens, the app will used to assessed and priority road segments in the field. Landowners may also use to prioritize their own efforts as well as for supporting funding requests. Target areas have been identified in the basin for forestland road erosion inventories in the Implementation Table in Chapter 5. Basin-specific forestland workgroups are also a priority for establishment to coordinate activities for outreach, training, implementation, and funding in priority areas. These workgroups are planned to include staff from FPR, FWD, Natural Resource Conservation Districts (NRCDs), Regional Planning Commissions (RPCs), watershed groups, United States Fish and Wildlife Service (USFWS), and the Natural Resource Conservation Service (NRCS).

Chapter 5 – The Basin 2 & 4 Implementation Table

A. Progress in Basin 2 & 4

The previous Basin 2 & 4 plan was completed in 2017. A total of 67 strategies were identified in the plan. Sixty-three (or 94%) have been implemented or are in progress by ANR and its watershed partners, 4 are awaiting action and have been carried over to this plan, and 0 have been discontinued.

The TBP addresses all impaired and altered waters in the basin as well as protection needs for high quality waters. The list of strategies in the Implementation Table (Table 19) and the Monitoring and Assessment Table (Table 20) cover future assessment and monitoring needs, as well as projects that protect or restore waters and related education and outreach.

The process for identifying priority strategies is the result of a comprehensive review and compilation of internal ANR and external watershed partner monitoring and assessment data and reports. The monitoring and assessment reports include SWMPs and stormwater mapping reports, SGAs, RCPs, bridge and culvert assessments, Hazard Mitigation Plans, flood modeling, agricultural modeling and assessments, REIs, biological and chemical monitoring, lake assessments, fisheries assessments, and natural communities and biological diversity mapping.

The Water Investment Division's Clean Water Initiative Program (CWIP) funds, tracks, and reports on priority projects to restore Vermont's waters, and communicates progress toward meeting water quality restoration targets outlined in the TMDLs. CWIP also coordinates funding, tracking, and reporting of clean water efforts for federal and state partners, including Clean Water Initiative partner state agencies – the Agencies of Agriculture, Food and Markets; Commerce and Community Development; Natural Resources; and Transportation – and the Lake Champlain Regional Conservation Partnership Program of the Natural Resources Conservation Service.

The Division's reporting on progress occurs annually for the basin regarding financial investments made and phosphorus loads addressed. A report card for each of the 67 strategies from the 2017 plan will be in the Appendix of the upcoming Vermont Clean Water Initiative 2022 Performance Report. Progress made in addressing the strategies in the 2022 Basin 2 & 4 Implementation Table will be reported in the 2027 TBP and the CWIP 2025 and 2027 Performance Reports.

B. Coordination of Watershed Partners

There are several active organizations undertaking watershed monitoring, assessment, protection, restoration, and education and outreach projects in Basin 2 & 4 in coordination with the ANR. These partners are non-profit, private, state, federal, or other organizations working on both private and public lands. Partnerships are crucial in carrying out non-regulatory projects to improve water quality. The Poultney Mettowee Natural Resources Conservation District (PMNRCD),

Rutland Regional Planning Commission (RRPC), Natural Resource Conservation Service (NRCS), UVM Extension Service, US Fish and Wildlife Service (USFWS), VAAFM, Vermont Agency of Transportation (VTrans), Vermont Land Trust (VLT), Vermont River Conservancy (VRC), Trout Unlimited (TU), Vermont Natural Resources Council (VNRC), The Nature Conservancy (TNC), lake associations, and municipal groups are active in:

- providing outreach and education to local stakeholders, private landowners, and municipalities,
- developing stream and floodplain protection and restoration projects (e.g., river corridor easements, tree plantings, culvert and bridge upgrades, dam removals, stream channel habitat restoration),
- developing stormwater projects (e.g., SWMPs, road erosion inventories, implementation of town road BMPs),
- working with farms in the basin developing and implementing BMPs for water quality, and
- monitoring water quality (e.g., lay monitoring program on lakes and numerous water quality monitoring programs in rivers).

The work necessary to meet water quality goals in this basin requires collaboration among all these groups to maximize the effectiveness of watershed partners. Without funding or partners, little of this work would be possible. The Agency is grateful for the active engagement and long-term commitment of so many South Lake Champlain Basin partner organizations and interested citizens.

C. Basin 2 & 4 Implementation Table

The Implementation Table (IT, Table 19) provides a list of 62 priority strategies created with the intention to be used as the go-to guide in the first step toward watershed action. The IT also provides specificity for where each strategy should be focused by identifying priority sub-basins and towns. A list of related individual project entries is found in the online Watershed Projects Database (WPD). The projects in WPD vary in level of priority based on the strategies outlined in the table. All projects in WPD are not expected to be completed over the next five years, but each strategy in the table is expected to be implemented and reported upon in subsequent phases of TMDL implementation plans and attendant interim and final TBP report cards included in annual Clean Water Performance Reports.

In relation to the Lake Champlain Phosphorus TMDL, IT strategy progress will be measured against the 5-year total TP reduction targets for each sector, outlined in Chapter 3. These reduction targets are addressed through both the regulatory programs described in Chapter 3 and the prospective reductions assigned to Act 76 Clean Water Service Providers and guided by the IT strategies. The effectiveness of those strategies and related implementation efforts will be measured according to TP reductions estimated for each sector. Clean water project tracking and accounting carried out by CWIP will estimate the mass of pollutants reduced from projects supporting IT strategies that will help monitor progress towards achieving those strategies and the 5-year target milestones. Progress

achieved through outreach, technical assistance, and project funding will inform VDEC's gap analysis related to each subsequent phase of TMDL implementation, each annual Clean Water Performance Report, and attendant interim and final TBP report cards.

As projects are developed, priority for CWIP funding will be given to those projects that achieve the highest water quality benefits. Additionally, projects that provide cumulative benefits (i.e., flood resiliency, water quality improvement, water resource protection, aquatic organism passage) will receive additional consideration for prioritization. For these priorities to be achieved, partners and stakeholders must help to carry out the strategies identified in the basin plan.

Table 19. Implementation strategies for the Basin 2 & 4 Tactical Basin Plan. See List of Acronyms on page 115-116.

Strategy Description	Priority Subbasin(s)	Priority Towns	Partners	Funding
STRATEGIES TO ADDRESS RUNOFF FROM AGRICULTURAL LANDS				
1. Identify and implement innovative projects supported by VAAFM or CWSPs/BWQCs in consultation with VAAFM to help achieve P reduction targets.	McKenzie Brook watershed (including Hospital, Stony, and Whitney Creeks, and Braisted Brook), East Creek, Hubbardton River, and Mettowee River	Charlotte, Ferrisburgh, Panton, Addison, Bridport, Shoreham, Orwell, Dorset, Danby, Rupert, Pawlet	PMNRCD, OCNRCD, NRCS, VAAFM, RRPC, VDEC	Project Development Block Grants, VAAFM Water Quality Grants, NRCS Funding, USFWS Funding, LCBP, VDEC RCPP, Water Quality Restoration Formula Grant
2. Identify and implement clean water projects reviewed by VAAFM (e.g., Wetland Restoration Easement, River Corridor Easement, Stream Restoration Project, Riparian Buffer Projects) to help achieve P reduction targets.	McKenzie Brook watershed (including Hospital, Stony, and Whitney Creeks, and Braisted Brook), East Creek, Hubbardton River, and Mettowee River	Charlotte, Ferrisburgh, Panton, Addison, Bridport, Shoreham, Orwell, Dorset, Danby, Rupert, Pawlet	PMNRCD, OCNRCD, NRCS, VAAFM, RRPC, VDEC	Project Development Block Grants, VAAFM Water Quality Grants, NRCS Funding, USFWS Funding, LCBP, VDEC RCPP, Water Quality Restoration Formula Grant
3. Implement priority projects that address significant sources of nutrient inputs with a focus on conservation tillage, cover cropping, manure injection, and agricultural production-area BMPs to help meet phosphorus reduction targets.	McKenzie Brook watershed (including Hospital, Stony, and Whitney Creeks, and Braisted Brook), East Creek, Hubbardton River, and Mettowee River	Charlotte, Ferrisburgh, Panton, Addison, Bridport, Shoreham, Orwell, Dorset, Danby, Rupert, Pawlet	PMNRCD, OCNRCD, NRCS, VAAFM, VDEC	Design and Implementation Block Grant, River Corridor Easement Block Grant, VAAFM Water Quality Grants, NRCS Funding, USFWS Funding, LCBP, VDEC RCPP, VHCB
4. Support farmers in developing new NMPs and maintaining and updating them over time.	Basin wide	All towns	PMNRCD, OCNRCD, NRCS, VAAFM, VDEC	VAAFM Water Quality Grants, NRCS Funding, USFWS Funding, LCBP, VDEC RCPP

5. Implement NMP recommendations in priority sub-basins to reduce fields with excessive or high soil phosphorus levels.	McKenzie Brook watershed (including Hospital, Stony, and Whitney Creeks, and Braisted Brook), East Creek, Hubbardton River, and Mettowee River	Charlotte, Ferrisburgh, Panton, Addison, Bridport, Shoreham, Orwell, Dorset, Danby, Rupert, Pawlet	PMNRCD, OCNRCD, NRCS, VAAFM, VDEC	VAAFM Water Quality Grants, NRCS Funding, USFWS Funding, LCBP, VDEC RCPP
6. Convene annual meeting of the VT Ag. water quality partnership to carry out and track strategies identified in the 2022 South Lake Champlain Tactical Basin Plan.	Basin wide	All towns	Poultney Mettowee NRCD and Rutland County NRCDs (Southwest Regional Partnership), VAAFM, UVM Extension, OCNRCD, NRCS, VAAFM, USFWS, FWD	TBP Support Grant, VAWQP funding
7. Provide education, outreach, and technical assistance to agricultural communities about field BMPs and the use of innovative equipment in priority sub-basins.	McKenzie Brook watershed (including Hospital, Stony, and Whitney Creeks, and Braisted Brook), East Creek, Hubbardton River, and Mettowee River	Charlotte, Ferrisburgh, Panton, Addison, Bridport, Shoreham, Orwell, Dorset, Danby, Rupert, Pawlet	Poultney Mettowee NRCD and Rutland County NRCDs (Southwest Regional Partnership), VAAFM, UVM Extension, NRCS, VAAFM, FNLC	VAAFM Water Quality Grants, Ag-CWIP, FAP
8. Provide technical and financial assistance to farmers to acquire equipment necessary for effective implementation of BMPs such as cover cropping and no or minimal tillage.	Basin wide	All towns	PMNRCD, VAAFM, NRCS, VDEC, UVM Extension Service, CVFC	VAAFM Water Quality Grants, Ag-CWIP, FAP, VDEC RCPP

9. Continue funding to support the VAAFM Farm Agronomic Practices (FAP) Program and Pay For Phosphorus (PFP) Program, Conservation Reserve Program (CRP),Grazing Technical Assistance (TA), and NRCS investments in soil- based agronomic practices to improve soil health, increase crop production, and reduce erosion and surface runoff from agricultural fields and to meet phosphorus reduction targets.	Basin wide	All towns	VAAFM, UVM Extension Service, NRCS, VDEC	VAAFM Water Quality Grants, NRCS Funding, VDEC RCPP
10. Support monitoring efforts to identify water quality issues and track results of practices implemented to address issues.	Basin wide	All towns	PMNRCD, VDEC -MAP	LaRosa Partnership Program, Lakes Lay Program, VDEC RCPP
STRATEGIES TO ADDRESS RUNOFF FROM DEVELOPED LANDS – STORMWATER				
11. Complete Stormwater Master Plans and identify high and medium priority projects.		Dorset	PMNRCD, Town of Dorset, VDEC	Project Development Block Grant, Water Quality Restoration Formula Grant

12. Provide technical assistance, education, and outreach to encourage towns and residents to reduce stormwater runoff from private properties using initiatives such as Raise the Blade, Lawn to Meadow, Lake Wise, Rethink Runoff, or other established programs and techniques.	Basin wide	All towns	Lake Champlain Sea Grant Program, Conservation Commissions, PMNRCD, RRPC, Municipalities, Rethink Runoff, VDEC	Lake Champlain Sea Grant, TBP Support Grant
13. Provide technical assistance and funding to develop high and medium priority projects from recently completed SWMPs and Phosphorus Control Plans with a focus on priority sub-basins.	Flower Brook, Castleton River headwaters, Lake Bomoseen Watershed, Lower Castleton River Watershed, Lake St. Catherine	Pawlet, Castleton, Poultney, Hubbardton, Fair Haven, West Rutland, Wells, Tinmouth, Middletown Springs	PMNRCD, RRPC, private landowners, Lake Associations, Municipalities	Project Development Block Grant, Water Quality Restoration Formula Grant
14. Provide outreach and technical assistance to homeowner associations, municipalities, and private landowners with 3-acre parcels to support early design and implementation of stormwater practices to meet the 3-acre permit requirements.	Basin wide	Castleton, Dorset, Fair Haven, Pawlet, Poultney, Rupert, West Haven, West Rutland	PMNRCD, RRPC, VDEC	LCBP Green Schools Initiative, ARPA 3-acre funds
15. Implement high and medium priority stormwater projects from SWMPs and stormwater mapping reports.	Segments receiving stormwater runoff in priority catchments	See Table 17.	RRPC, PMNRCD, VDEC	Design-Implementation Block Grant, Water Quality Restoration Formula Grant

16. Provide education and outreach on VDEC standards and training opportunities for operations and maintenance of installed stormwater BMPs.	Basin wide	All towns with VDEC funded stormwater practices	RRPC, PMNRCD, Municipalities	VDEC - CWIP, Lake Champlain Sea Grant
17. Provide technical assistance and funding for the implementation of Private Public Partnership projects to achieve compliance with the three-acre rule.	Basin wide	Future P3 communities	RRPC, PMNRCD, VDEC	ARPA 3-acre funds
18. Implement projects addressing vulnerabilities from flooding and fluvial erosion from county and municipal All-Hazards Mitigation Plans where water quality improvements are present.	Basin wide	All towns	RRPC, Municipalities	Municipal Planning Grants, FEMA
STRATEGIES TO ADDRESS RUNOFF FROM DEVELOPED LANDS – ROADS				
19. Provide general support and technical assistance to towns for MRGP compliance.	Basin wide	All towns	RRPC, PMNRCD, VDEC, VTrans, Municipalities	TBP Support Grant, VDEC - CWIP, Capacity Development Grants
20. Complete private road REIs to identify priority road segments for restoration.	Basin wide	All towns	RRPC, PMNRCD, VTrans, VDEC-CWIP, Municipalities	VDEC - CWIP, Capacity Development Grants
21. Provide outreach and funding for MRGP equipment for towns.	Basin wide	All towns	RRPC, PMNRCD, VTrans, VDEC-CWIP, Municipalities	VDEC - CWIP, Capacity Development Grants, Grants-Aid-Small Equipment Grant
22. Implement high priority road projects identified in MRGP REIs, LWAPs, and SWMPs to achieve compliance with the MRGP and meet phosphorus reduction targets.	Basin wide	All towns	RRPC, PMNRCD, Municipalities, Lake Associations	VTrans Municipal Roads Grant-In-Aid Program, VTrans Better Roads, Regional Transportation Funds, Design-Implementation Block

				Grant
23. Provide outreach and support to towns and contractors to attend Road Roundtable Forums.	Basin wide	All towns	RRPC, PMNRCD, Municipalities, VDEC - Stormwater	VDEC - Stormwater, TBP Support Grant
24. Support towns to adopt the Vermont Road and Bridge Standards to increase ERAF rating.	Basin wide	All towns	RRPC, Municipalities	TBP Support Grant
25. Replace or remove bridges and culverts identified as barriers to AOP and/or that are geomorphically incompatible.	Basin wide	All towns	RRPC, PMNRCD, Municipalities, VDEC - Stormwater	VTrans Municipal Roads Grant-In-Aid Program, VTrans Better Roads, Regional Transportation Funds, Design-Implementation Block Grant
26. Implement 6 minimum control measures (MCMs) required in the State TS4 permit.	Basin wide	All towns	VTrans	VTrans
STRATEGIES TO ADDRESS WASTEWATER				
27. Provide information about ANR Village Wastewater Solutions to any communities that have inadequate individual onsite wastewater treatment on small, challenging sites, and funding for planning and implementation of priority projects that are identified and have community support.	Basin wide	All towns	VDEC - Water Investment Division, RRPC, PMNRCD, Municipalities	CWSRF, ARPA funds, USDA Community Facilities Program, TBP Support Grant
28. Support relocation of septic systems and/or floodproofing of on-site septic systems.	Flower Brook	Pawlet	VDEC - Engineering &Facilities, Municipalities	CWSRF, ARPA funds, USDA Community Facilities Program, TBP Support Grant

29. Support upgrades to public wastewater treatment facilities.	Hubbardton River Trib #7 below WWTF, Castleton River, South Fork East Creek, Indian River, Poultney River	Benson, Castleton, Fair Haven, Orwell, Pawlet, Poultney	Municipalities, WID	CWSRF, USDA RD
30. Provide support and materials to lake communities to host Wastewater Workshops (formerly Septic Socials).	Lake St. Catherine, Lake Bomoseen, Lake Hortonia	Hubbardton, Castleton	Lake Associations, VDEC Lakes, VDEC - Wastewater	Watershed Planning Grant
STRATEGIES TO SUPPORT NATURAL RESOURCE PROTECTION AND RESTORATION - RIVERS				
31. Review existing Stream Geomorphic Assessments (SGAs) and River Corridor Plans (RCPs) and identify and develop projects with focus on segments that reduce sediments and nutrients.	Basin wide- focus on Castleton River, Mettowee River, Poultney River, East Creek	Castleton, Fair Haven, Ira, Poultney, Wells, Orwell, Benson, Addison, Bridport, Shoreham	PMNRCD, RRPC, VDEC – Rivers	Project Development Block Grant, River Corridor Easement Block Grant, Water Quality Restoration Formula Grant
32. Implement priority projects and actions identified in SGAs and RCPs and supported by the Functioning Floodplain Initiative (FFI) tool.	Basin wide- focus on Castleton River, Mettowee River, Poultney River, East Creek, Flower Brook, Indian River	Castleton, Fair Haven, Ira, Poultney, Wells, Orwell, Benson, Addison, Bridport, Shoreham	PMNRCD, RRPC, VLT, VDEC – Rivers	Design and Implementation Block Grant, River Corridor Easement Block Grant, Water Quality Restoration Formula Grant
33. Provide training on the use of the FFI tool for watershed partners.	Basin wide	All towns	VDEC – Rivers	TBP Support Grant
34. Support municipalities in updating flood hazard bylaws.	Basin wide	All towns	RRPC, VDEC – Rivers, Municipalities	TBP Support Grant, Municipal Planning Grants
35. Provide technical assistance and outreach to towns to adopt river corridor protections or strengthen existing river protection bylaws, setbacks, and zoning as new FEMA maps become available and towns are required to update bylaws to be FEMA compliant.	Basin wide	All towns	RRPC, VDEC - Rivers, Municipalities	TBP Support Grant, Municipal Planning Grants

36. Identify and develop potential dam removal projects.	Basin wide with a focus on streams impaired by encroachment and channel erosion.	All towns	VDEC - Rivers, VDEC - Dam Safety, PMNRCD, VNRC, USFS, VFPR, VFWD, TNC, Trout Unlimited, Native Fish Coalition, private landowners	Design-Implementation Block Grant, VT Stream Restoration and Protection Program RCPP Grant, National Fish Passage Program, National Fish Habitat Partnership, CWSRF, NFWF, Dam Removal Block Grant
37. Implement dam removal projects.	Basin wide with focus on Castleton River, Mettowee River, North Breton Brook, Austin Pond, Pond Hill Brook	All towns	VDEC - Rivers, VDEC - Dam Safety, PMNRCD, VFWD, VFPR, VNRC, USFS, TNC, Trout Unlimited, Native Fish Coalition, private landowners	Design-Implementation Block Grant, VT Stream Restoration and Protection Program RCPP Grant, National Fish Passage Program, National Fish Habitat Partnership, CWSRF, NFWF, Dam Removal Block Grant
38. Work with towns to consider joining the NFIP as part of an effort to increase ERAF rating.	Basin Wide	All towns	RRPC, Municipalities	TBP Support Grant, Municipal Planning Grants
39. Continue buffer plantings along rivers in priority locations.	Basin Wide	All towns	PMNRCD, Trout Unlimited, USFWS	Woody Buffer Block Grant, CREP, Trees for Streams
40. Complete river corridor easement projects along priority reaches where the greatest stream equilibrium can be achieved.	Basin Wide with a focus on the Poultney River, Castleton River	All towns	PMNRCD, VLT, VRC, TNC, TU, VDEC-Rivers	River Corridor Easement Block Grant
41. Provide outreach to towns to develop petitions for reclassification of A(2) waters where they are no longer used as a public water source.	A(2) waters sources only	Fair Haven, Ira, West Rutland	RRPC, PMNRCD, VDEC-MAP, Municipalities	TBP Support Grant

42. Provide outreach to towns on opportunity to reclassify waters for B(1)for fishing and aquatic biota use.	North Breton Brook, Sykes Hollow Brook, Mettowee River	Castleton, Rupert, Dorset, Pawlet	RRPC, PMNRCD, VDEC-MAP, Municipalities	TBP Support Grant
STRATEGIES TO SUPPORT NATURAL RESOURCE PROTECTION AND RESTORATION - LAKES				
43. Initiate stakeholder meeting to discuss lay monitoring and Lake Wise on target lakes with fair to poor shoreland scores.	Little Lake, Lily (Poultney), Lake St. Catherine, Lake Bomoseen, Coggman, Old Marsh, Pine Lake, Loves Marsh, Half Moon, Black, Mill, Breese, Austin, Roach, Beebe, Echo, Hortonia, Perch, Sunset, Sunrise, Burr, Hough	Wells, Poultney, Hubbardton, Benson, Orwell	PMNRCD, RRPC, VDEC-Lakes, Municipalities, private landowners, FWD	TBP Support Grant
44. Identify and coordinate stakeholders to work with VDEC to develop an invasive species management plan for the waterbody.	Black Pond	Hubbardton	PMNRCD, FWD, VDEC-Lakes	TBP Support Grant
45. Continue to monitor AIS in lakes to reduce the spread of Eurasian Water Milfoil.	Lake Beebe, Burr, Lake Hortonia, Lily, Lake St. Catherine, Sunrise Lake, and Little (Wells), Lake Bomoseen	Hubbardton, Castleton	VDEC-Lakes, Lakes Associations	TBP Support Grant, Aquatic Nuisance Control Grant-In-Aid Program
46. Maintain and build the capacity for the Greeter & VIP Program to monitor and manage AIS.	Lake Bomoseen, Echo Lake, Lake Beebe, Burr, Lake Hortonia, Lily, Lake St. Catherine, Sunrise, and Little (Wells)	Hubbardton, Castleton	VDEC-Lakes, Lake Associations, PMNRCD	Aquatic Nuisance Control Grant-In-Aid Program

47. Develop Lake Watershed Action Plan (LWAP) and provide outreach to the community on the plan and proposed actions, including installation of riparian buffers on lake tributaries.	Lake Bomoseen	Hubbardton, Castleton	PMNRCD, Lake Bomoseen Association, VDEC-Lakes, Municipalities	Design-Implementation Block Grant, Water Quality Restoration Formula Grant, Enhancement Grant, Woody Buffer Block Grant
48. Design and implement projects identified through Lake Wise assessments, LWAPs, or Lake SWMPs.	Lake Bomoseen, Lake St. Catherine, Beebe, Lake Hortonia, Burr, Sunrise, Sunset	Hubbardton, Castleton, Sudbury, Poultney, Wells, Benson, Orwell	PMNRCD, VDEC-Lakes, Lake associations	Design-Implementation Block Grant, Water Quality Restoration Formula Grant, Enhancement Grant
49. Maintain AIS signage at lake access areas.	Lake Bomoseen, Echo Lake, Lake Beebe	Hubbardton	VDEC-Lakes, FWD, Lake Associations	Aquatic Nuisance Control Grant-In-Aid Program
STRATEGIES TO SUPPORT NATURAL RESOURCE PROTECTION AND RESTORATION - WETLANDS				
50. Provide outreach and technical assistance for Class I wetland assessment, stakeholder discussions, and petition development where there is interest.	South Fork of East Creek	Orwell and Benson	VDEC-Wetlands, Municipalities, PMNRCD, OCNRCD, RRPC, TNC	TBP Support Grant
51. Provide support to the Wetlands Program for publicizing and promoting wetland mapping updates to improve mapping of the watershed.	Basin wide wetlands	All towns	RRPC, PMNRCD, VDEC-Wetlands, Municipalities	TBP Support Grant

52. Restore previously drained and degraded wetlands identified in RCPs, Wetland Restoration Assessments, high scores on the Wetland Restoration Potential layer on the ANR Atlas and assessments, and field surveys.	Basin wide with focus on East Creek watershed	All towns with focus on Ferrisburgh, Shoreham, Orwell, Benson	OCNRCD, VDEC-Wetlands, VDEC-Rivers, VDEC RCPP, VLT, VRC	NRCS WRE, Clean Water Funds, Project Development Block Grant, Design - Implementation Block Grant, VDEC RCPP, LCBP
STRATEGIES TO SUPPORT NATURAL RESOURCE PROTECTION AND RESTORATION - FORESTS				
53. Maintain and increase UVA enrolled forestland among eligible parcels by providing outreach and technical assistance to private landowners and foresters to equip them with tools to apply, enroll and manage their land in accordance with program standards, including implementation of AMPs.	Basin wide	All towns with a focus on Benson, Poultney, Wells, Castleton, and Middletown Springs	PMNRCD, RRPC, FPR	TBP Support Grant
54. Develop a workgroup for forestland collaborative efforts in priority watersheds to carry out strategies in the 2022 South Lake Champlain TBP.	Basin wide	All towns	PMNRCD, RRPC, FPR, NRCS, FWD, USFWS, USFS, VLT, TNC	TBP Support Grant
55. Provide outreach through towns on information about temporary skidder bridges and forestry AMPs.	Basin wide	All Towns	RRPC, RNRCD, PMNRCD, Municipalities	TBP Support Grant
56. Implement AMPs and priority road projects on state lands through REI, prioritization, and implementation.	Lake St. Catherine (Lake St. Catherine State Park), Lake Bomoseen (Bomoseen State Park), Half Moon Pond (Half Moon Pond State Park)	S. Poultney, Castleton, Hubbardton	FPR, VDEC	Clean Water Funds

57. Provide outreach to forestland managers on the use of the REI App. in priority sub-basins.	Basin wide	All towns	FPR, VDEC	TBP Support Grant
58. Complete REIs on state lands.	Basin wide	All towns	FPR, VDEC	TBD
59. Implement private forest road restoration projects in priority sub-basins.	Basin wide	All towns	NRCS, ANR	NRCS, Water Quality Restoration Formula Grant, RCPP
60. Identify headwaters and sensitive surface waters in large forest blocks for protection through conservation easement and land acquisition.	Basin wide with focus on Flower Brook	Pawlet	PMNRCD, RRPC, FPR, FWD, TNC, VLT, VRC, TU	TBP Planning Grants, RCE Block Grants
61. Implement forestland conservation practices and land conservation projects.	Basin wide	All towns	NRCS, ANR, PMNRCD, VLT, USFS, USFWS, FPR, FWD, TNC, VLT	EQIP, Vermont Housing and Conservation Trust Fund, Forest Legacy Program, RCPP, RCE Block Grants
STRATEGIES TO SUPPORT NATURAL RESOURCE PROTECTION AND RESTORATION – SURFACE WATERS				
62. Support monitoring efforts on priority surface waters as identified in the 2022 South Lake TBP Monitoring & Assessment Table.	see monitoring & assessment table	see monitoring & assessment table	VDEC-Lakes, MAP, Wetlands, Rivers; Volunteer Monitors, LaRosa Partnership Program, PMNRCD	LaRosa Partnership Program, Lakes Lay Monitoring Program, VDEC

D. Basin 2 & 4 Monitoring and Assessment Table

The Monitoring and Assessment Table (Table 20) provides a preliminary list of 45 water quality monitoring priorities to guide monitoring over the next five years. The ANR's Water Quality Monitoring Strategy describes the monitoring programs supported by both the ANR and its partners, which are also listed in Chapter 2. Common goals for monitoring efforts across programs include identifying water quality conditions and trends as well as pollution sources and tracking improvements over time. The table includes more sites than there is capacity to sample and as a result, will be further prioritized before monitoring occurs in 2024.

Table 20. Basin 2 & 4 priorities for monitoring and assessment. Monitoring on private lands requires landowner permission.

Waterbody	Project Description	Location	Partner(s)	Purpose
Lakes and Ponds				
1. Fair Haven-W	Chemical monitoring	Fair Haven	VDEC - Lakes	Insufficient data to determine water quality status. High percentage of impervious surface in watershed.
2. Fan	Chemical monitoring	Wells	VDEC - Lakes	Insufficient data to determine water quality status. High percentage of impervious surface in watershed.
3. Prentiss	Chemical monitoring	Dorset	VDEC - Lakes	Insufficient data to determine water quality status. High percentage of impervious surface in watershed.
4. Quarry	Chemical monitoring	Castleton	VDEC - Lakes	Insufficient data to determine water quality status. High percentage of impervious surface in watershed.
5. Scotch	Chemical monitoring	Fair Haven	VDEC - Lakes	Insufficient data to determine water quality status. High percentage of impervious surface in watershed.
6. Identified Lakes and Ponds	Complete AIS survey.	Multiple	VDEC - Lakes	Generate AIS status of lakes and ponds with no data.
Rivers and Streams				
7. Larrabees North	Biological and chemical monitoring.	Shoreham	VDEC - MAP	Data gap. High percentage of agriculture in watershed.
8. Larrabees South	Biological and chemical monitoring.	Shoreham	VDEC - MAP	Data gap. High percentage of agriculture in watershed.

9. Jones Brook	Biological and chemical monitoring.	Orwell	VDEC - MAP	Data gap. Moderate sized watershed with no data.
10. Pepper Brook	Biological and chemical monitoring.	Orwell	VDEC - MAP	Data gap. High percentage of agriculture in watershed.
11. Lake Creek	Biological and chemical monitoring.	Benson	VDEC - MAP	Data gap. High percentage of agriculture in watershed.
12. Carter Creek	Biological and chemical monitoring.	Benson	VDEC - MAP	Data gap. High percentage of agriculture in watershed.
13. York Street Creek	Biological and chemical monitoring.	Poultney	VDEC - MAP	Data gap. High percentage of agriculture in watershed.
14. Bull Frog Brook	Biological and chemical monitoring.	Wells	VDEC - MAP	Data gap. High percentage of impervious surface in watershed.
15. Pawlet Brook	Biological and chemical monitoring.	Pawlet	VDEC - MAP	Data gap. High percentage of agriculture in watershed.
16. Hospital Creek, Mouth to rm 3.5	Biological and chemical monitoring.	Addison	VDEC - MAP	Turbidity, P. Runoff from agricultural lands Determine status for aquatic biota.
17. Braisted Brook	Biological and chemical monitoring.	Bridport	VDEC - MAP	Determine status for aquatic biota.
18. East Creek-North Fork	Biological and chemical monitoring.	Orwell	VDEC - MAP	Station 2.2. Unable to assess in 2019 due to drought. Nutrients from agricultural activities. Determine status for aquatic biota.
19. Bump School Brook	Biological and chemical monitoring.	Benson	VDEC - MAP	Determine status for aquatic biota.
20. Sucker Brook	Biological and chemical monitoring.	Castleton	VDEC - MAP	Determine status for aquatic biota.
21. Coggman Creek Mouth Up to rm 2.9	Biological and chemical monitoring.	West Haven	VDEC - MAP	Station 2.2. Unable to assess in 2019 due to beaver dam. Sedimentation/siltation. Undefined source. Determine impairment status for aquatic biota.
22. Pond Hill Brook	Biological and chemical monitoring	Castleton	VDEC - MAP	Determine impairment status for aquatic biota.
23. Poultney River, from rm 21.8 Up 3 Miles	Biological and chemical monitoring	Poultney	VDEC - MAP	Temperature and organic enrichment. Poultney village and agriculture are adjacent land uses. Determine status for aquatic biota.

24. Vail Brook	Biological and chemical monitoring.	Middletown Springs	VDEC - MAP	Determine status for aquatic biota
25. Gully Brook	Biological and chemical monitoring.	Castleton	VDEC - MAP	Station 0.5. Unable to sample in 2019 due to drought.
26. Lake Champlain Trib.	Biological and chemical monitoring.	Shoreham	VDEC - MAP	Station 0.1. Unable to sample in 2019 due to drought.
Wetlands				
27. Ward Marsh	Wetland assessment, spatial data	West Haven	VDEC - Wetlands	Assessment for Class I wetland considerations.
28. Lake Bomoseen wetland	Wetland assessment	Hubbardton	VDEC - Wetlands	Potential monitoring site. Located north of Float Bridge.
29. Lake St. Catherine wetland	Wetland assessment	Poultney	VDEC - Wetlands	Potential monitoring site. Wetland surrounded by golf course draining into the lake.
30. Little Lake wetland(s)	Wetland assessment	Wells	VDEC - Wetlands	Potential monitoring site. Any wetland(s) associated with the lake.
31. Mill Brook wetland(s)	Wetland assessment	Dorset	VDEC - Wetlands	Potential monitoring site. Any wetland(s) associated with Mill Brook running under Scallop Dr.
32. Danby wetland(s)	Wetland assessment	Danby	VDEC - Wetlands	Potential monitoring site.
33. Tinmouth Channel	Wetland reassessment	Tinmouth	VDEC - Wetlands	Class I wetland since 2001. Additional data collection.
34. South Brook wetland(s)	Wetland assessment	Middletown Springs	VDEC - Wetlands	Potential monitoring site. Any wetland(s) along Route 133.
35. Red Maple-Northern White Cedar Swamp	Wetland assessment	Fair Haven	VDEC - Wetlands	Potential monitoring site.
36. Castleton River wetland(s)	Wetland assessment	Fair Haven and Castleton	VDEC - Wetlands	Potential monitoring site. Any wetland(s) along Route 30.
37. Ward Marsh	Wetland assessment	Poultney	VDEC - Wetlands	Additional wetland north and south of Ward Marsh- potential Class I wetland along the Poultney River.
38. Hubbardton River wetland(s)	Wetland assessment	Benson and West Haven	VDEC - Wetlands	Potential monitoring site. North crossing Route 22A and South behind Devils Speed Bowl into West Haven.

39. Lake Champlain wetland(s)	Wetland assessment	Benson	VDEC - Wetlands	Potential monitoring site. Back bay of Lake Champlain off Lake Road at the Landing access area.
40. Stacy Brook wetland(s)	Wetland assessment	Benson and Orwell	VDEC - Wetlands	Potential monitoring site. Any wetland(s) associated with Stacy Brook, parallel to Route 22A from Benson North into Orwell to the confluence with the South Fork of East Creek.
41. Mud Pond wetland(s)	Wetland assessment	Benson	VDEC - Wetlands	Potential monitoring site.
42. East Creek Waterfowl Area wetland(s)	Wetland assessment	Orwell	VDEC - Wetlands	Potential monitoring site.
43. Lake Champlain wetland	Wetland assessment	Shoreham	VDEC - Wetlands	Potential monitoring site.
44. Hospital Creek wetland(s)	Wetland assessment	Addison	VDEC - Wetlands	Potential monitoring site. Any wetland(s) associated with Hospital Creek or back waters South near 10 Acres campground.
45. DAR State Park	Wetland assessment	Addison	VDEC - Wetlands	Potential monitoring site. Any wetland(s) near or within DAR SP.

List of Acronyms

604(b)	Federal Clean Water Act, Section 604b
ACWIP	Agricultural Clean Water Initiative Grant Program
AIS	Aquatic Invasive Species
AMPs	Acceptable Management Practices (for logging)
ANC	Aquatic Nuisance Control grant
ANR	Vermont Agency of Natural Resources
AOP	Aquatic Organism Passage
AOT	Vermont Agency of Transportation
BASS	Biomonitoring and Aquatic Studies Section
BMP	Best Management Practices
BR	Better Roads
CCNRCD	Caledonia County Natural Resources Conservation District
CCRPC	Chittenden County Regional Planning Commission
CEAP	Capital Equipment Assistance Program
CREP	Conservation Reserve Enhancement Program
CWI	Clean Water Initiative Grant Funding
CWIP	Clean Water Initiative Program
CWSRF	Clean Water State Revolving Fund
CVRPC	Central Vermont Regional Planning Commission
VDEC	Department of Environmental Conservation
RPC	Regional Planning Commission
EBTJV	Eastern Brook Trout Joint Venture
EQIP	Environmental Quality Incentive Program
ERP	Ecosystem Restoration Program
FAP	Farm Agronomic Practices
FNLC	Friends of Northern Lake Champlain
FPR	Vermont Department of Forests, Parks, and Recreation
FWD	Vermont Fish and Wildlife Department
GIS	Geographic Information System
GSI	Green Stormwater Infrastructure
IDDE	Illicit Discharge Detection (and) Elimination
LULC	Land Use Land Cover
LCCD	Lamoille County Conservation District
LCPC	Lamoille County Planning Commission
LFO	Large farm Operation
MAB	Municipal Assistance Bureau
MAP	Monitoring and Assessment and Program
MFO	Medium Farm Operation
MPG	Municipal Planning Grant
MRGP	Municipal Roads General Permit
NFIP	National Flood Insurance Program
NFWF	National Fish and Wildlife Foundation
NMP	Nutrient Management Plan
NPS	Non-point source pollution
NRCD	Natural Resources Conservation District
NRCS	Natural Resources Conservation Service
NRPC	Northwest Regional Planning Commission
NVDA	Northeast Vermont Development Association
OCNRCD	Orleans County Natural Resources Conservation District
ORW	Outstanding Resource Water
RAP	Required Agricultural Practices
RPC	Regional Planning Commission
RCPP	Regional Conservation Partnership Program
RMP	River Management Program
SFO	Small Farm Operation
SGA	Stream Geomorphic Assessment
SWMP	Stormwater Master Plan
TBP	Tactical Basin Plan
TBPSG	Tactical Basin Planning Support Grants
TMDL	Total Maximum Daily Load
TU	Trout Unlimited
TNC	The Nature Conservancy

TS4	Transportation Separate Storm Sewer System General Permit
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UVA	Use Value Appraisal program, or Current Use Program
UVM Ext.	University of Vermont Extension Service
VAAFM	Vermont Agency of Agriculture, Food, and Markets
VACD	Vermont Association of Conservation Districts
VHCB	Vermont Housing and Conservation Board
VIP	Vermont Invasive Patrollers
VLCT	Vermont League of Cities and Towns
VLRP	Vermont Local Roads Program
VLT	Vermont Land Trust
VHCB	Vermont Housing and Conservation Board
VIP	Vermont Invasive Patrollers
VRAM	Vermont Rapid Assessment Method
VRC	Vermont River Conservancy
VTrans	Vermont Agency of Transportation
VWQS	Vermont Water Quality Standards
VYCC	Vermont Youth Conservation Corp
WISPr	Water Infrastructure Sponsorship Program
WNRCD	Winooski Natural Resources Conservation District
WRE	Wetland Reserve Easement Program

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Appendix A. Dams in Basin 2 & 4

Table A1. List of dams in Basin 2 & 4. These dams are either in service, partially breached, breached, or removed. Source: Vermont Dam Inventory (accessed: 04/22/2022).

Map ID	Dam Name	Purpose	Status	Map ID	Dam Name	Purpose	Status
17	Bird Mountain	NA	Deleted	23	Chizmar	Recreation	In Service
38	Beebe Pond	NA	Removed	32	Said	Recreation	In Service
2	Pawlet	Hydroelectric	In Service	46	Huff Pond	NA	Breached (Partial)
36	Luther	Recreation	In Service	37	Munger	Recreation	In Service
12	Shirt Factory	NA	In Service	45	East Creek Site No. 5	Recreation	In Service
14	Water Street	NA	In Service	39	Perch Pond	Fish and Wildlife Pond	In Service
25	Marold	NA	In Service	6	Northeast Developers	Recreation	In Service
34	Blair	NA	In Service	35	Austin Pond	Recreation	In Service
4	Mill Brook	NA	In Service	33	Parsons Mill	Recreation	In Service
3	Wells-6	NA	In Service	22	Pine Pond	Recreation	In Service
9	Coy Brook	NA	In Service	40	Sunrise Lake	Recreation	In Service
10	Buxton's Pond	NA	In Service	29	Loves Marsh	Recreation	In Service
11	Fenton	NA	In Service	42	Burr Pond	Recreation	In Service
16	Castleton State College	NA	In Service	43	Hinkum Pond	NA	In Service
28	Howard Pond	NA	In Service	48	East Creek Site No. 1	Recreation, Fish and Wildlife Pond	In Service
26	Sheldon Pond	NA	In Service	24	Inman Pond	Water Supply	In Service
30	Brown	Recreation	In Service	20	Old Marsh Pond	Recreation	In Service
1	Prentiss Pond	Recreation, Fish and Wildlife Pond	In Service	27	Glen Lake	Recreation	In Service
7	Schmidt	Recreation	In Service	41	Sunset Lake	Recreation	In Service
44	Maharay	Recreation	In Service	5	Little Pond	Recreation	In Service
47	East Creek Site No. 2	Recreation, Fish and Wildlife Pond	In Service	15	Lake Bomoseen	Recreation	In Service
19	Pelletier	Recreation	In Service	13	Slate Factory	NA	Breached

8	Schiff	Recreation	In Service	18	Coggman Pond	NA	NA
21	Castleton-7	NA	NA				
31	Sargent Pond	NA	Breached				
49	Jackson	NA	Deleted				

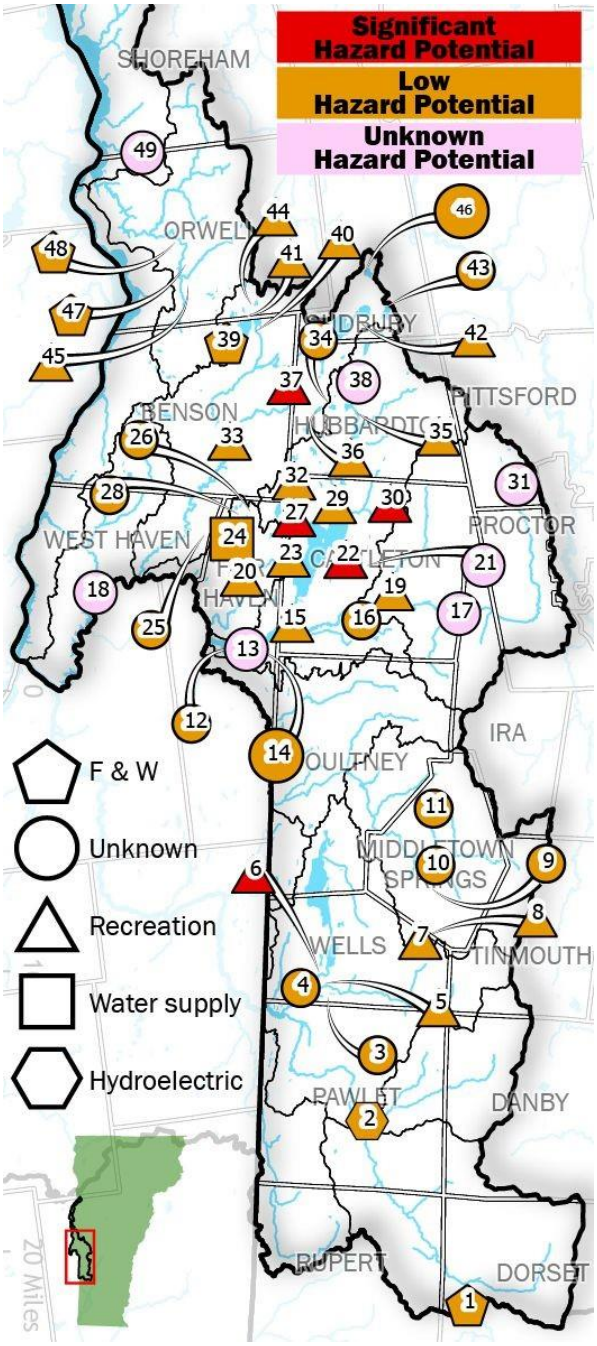

Figure A1. Map of dam records in Basin 2 & 4. Map #'s in table A1 correlate with the numbers in this map. Source: Vermont Dam Inventory (accessed: 4/20/2022).

Appendix B. Responsiveness Summary

Vermont Department of Environmental Conservation

Agency of Natural Resources

Responsiveness Summary to Public Comments Regarding:

Basin 2 & 4 Tactical Basin Plan

On October 7, 2022, the Vermont Department of Environmental Conservation (DEC) of the Agency of Natural Resources (ANR) released a final draft of the Basin 2 & 4 Tactical Basin Plan for a public-comment period. The public comment period, which ended on November 7, 2022, included two public meetings on October 27 and November 3, 2022. Press releases were also sent out to regional publications by DEC and the Regional Planning Commissions (RPCs). Two public meetings were additionally noticed by Basin 2 & 4 statutory partners.

Meetings for public comment:

- **October 27, 2022** – 5:30 PM – In-person Meeting & Presentation
- **November 3, 2022** – 5:30 PM – Virtual Online meeting & Presentation.

The DEC prepared this responsiveness summary to address specific comments and questions and to indicate how the plans have been modified in response to public comment. Comments may have been paraphrased or quoted in part. The full text of the comments provided for each plan individually is available for review by contacting the Water Investment Division.

Commenter – Rob Steele, Bomoseen, VT

1. **Comment**: In the plan it states, "Summer total phosphorus (TP) concentrations are significantly increasing for Lake Hortonia, Austin Pond and Hinkum Pond and spring TP concentrations are showing a significant increasing trend for Lake Bomoseen." Looking at the scorecard for Lake Bomoseen that I found on the DEC website, it shows the spring TP value as decreasing over the past 20 plus years and states that the spring phosphorus trend is significantly decreasing. It also shows summer TP levels as significantly increasing. It appears that the summer and spring information provided in the tactical plan is reversed.

   Response: There was an error in this section, and it has been corrected in the final draft of the plan (see Page 89 of the plan). Thank you for your time and careful review.

Commenter – Lynn Gee

2. **Comment**: a) Page 98 of the draft states "spring TP concentrations are showing a significant increasing trend for Lake Bomoseen." This does not agree with the information posted on the Vermont Lakes Scorecard for Bomoseen which shows a "significantly decreasing trend" for scoring TP concentration. Can you clarify? (The Scorecard does show a significantly increasing trend for summer TP concentrations however.)

   b) Also, I am wondering how up to date the Scorecard is. It shows nothing since 2020. I would like to

know what water quality data has been collected in recent years on Lake Bomoseen.

Response: a) There was an error in this section, and it has been corrected in the final draft of the plan. Thank you for your time and careful review.

b) The score card is up to date through 2021. It will be updated with this years' data once the data have been quality checked and uploaded to the database.

The Lakes and Ponds Program have not been to Bomoseen to monitor Spring TP since 2019. They only get to most lakes in the state once every 5-10 years and can only get to about 60-70 lakes per spring.

Commenter – Jody White

3. **Comment**: a) I kinda like milfoil, and I really don't like the option of using herbicide in lakes, which obviously colors my views on this. Over the summer, I met a boat launch inspector, who told me that something like 80 percent of the invasive species he found came in on trailers, not the actual boats. He suggested that focusing on removing invasive species right around the boat ramps might be a good way to keep trailers clear of milfoil or other species. It would probably result in some odd-looking bare ground, and maybe more turbid water near ramp, but raking, pulling or maybe suctioning milfoil or water chestnut or frogbit around the ramps in the area once a month while things are growing could be a good way to keep the lakes to themselves more.

   b) For Lake Scorecards, it kinda frustrates me that there are only two options on the invasive species front. I realize that if they're present it isn't ideal, but the idea that Lake Champlain has an equal amount of invasives to St. Catherine or Hortonia by the scorecard just strikes me as not totally making sense.

   c) I found the 2016 stormwater plan for Bomo (e.g., Lake Bomoseen), and there are a ton of problem areas listed. Is there are particular document or place I should look to see which areas have had something done about them? Based on my experience at the boat ramp there, and the listing in the 2016 document, I'd say that one in particular hasn't been addressed.

   Response: a) The Vermont Department of Environmental Conservation Lakes and Ponds Management Program (Lakes and Ponds Program) oversees the Aquatic Nuisance Control Program. That Program oversees spread prevention projects such as boat launch inspectors who are trained by the State staff to inspect boats *and trailers* (correct in that the likely source is from boat trailers). Within this program, municipalities partner with lake associations to apply for and receive Aquatic Nuisance Control Grant in Aid funds to support aquatic nuisance management control projects. Entities that complete projects specifically at launch sites are prioritized to receive these funds. Unfortunately, many waterbodies that are infested with aquatic invasive species, including many of the 100+ waterbodies with Eurasian Watermilfoil infestations, do not have municipalities or lake associations who are able to initiate such a project in the community. The State of Vermont Aquatic Nuisance Control Program also has limited funding available to address aquatic invasives. The Agency receives approximately $350,000 annually from Motorboat Registration fees to support the program, and the majority of these funds are used to fund the Aquatic Nuisance Control Grant in Aid.

   b) In reference to Lake Score Card options for the Aquatic Invasive Species, the "score" of red or green is challenging in that it doesn't demonstrate a range or number of species present. However, it is a helpful tool for conservation managers to use, especially as a geospatial tool, as a score of "red" demonstrates a threat to other waterbodies in proximity to that infested waterbody, regardless of the

number of species present.

c) Priority projects are implemented as watershed partners have the capacity to do so. The 2016 Lake Bomoseen SWMP was completed by PMNRCD with Fitzgerald Environmental Associates and

assessed 24,770 acres, identified 48 potential projects, and 20 were ranked as high priority. Six were selected for conceptual designs, two have final designs, and one was implemented. PMNRCD plans to complete more projects in 2023-24.

Commenter – Dan Brooks, West Pawlet, VT

4. **Comment**: I strongly believe that some inclusion of beavers and their value should be included in this plan so that towns and municipalities would have access to factual information about how to coexist with them by using beaver deceivers/flow devices, rather than spending more money on removal. The perception among many people is that beavers are nuisances to be eradicated rather than valued parts of our environment that should be encouraged.

   I'm providing a link to a study about the many ways in which beavers benefit our world that you mind find interesting: https://environment-review.yale.edu/busy-beavers-calculating-value-ecosystems-services-provided-beavers

   Response: The Agency agrees that beavers are a critical species that help to drive the dynamism of many Vermont ecosystems. This Tactical Basin Plan is focused on strategies for protecting and restoring surface water quality, but the Vermont Fish and Wildlife Department has compiled a number of resources related to managing human-beaver conflicts, which can be accessed here: https://vtfishandwildlife.com/beavers

   Beaver are a keystone species that are native to North America. Prior to European settlement they were abundant in Vermont but were essentially extirpated as a result of unregulated harvest and a human caused habitat shift from forest to agriculture. In response, many other native species likely declined, such as fish, aquatic organisms, otter, moose, waterfowl and other fish and wildlife which evolved with and, in many cases, depended on beaver created wetlands for survival. Beaver were reintroduced in the early 1900's because it was recognized that the creation of wetlands by beaver are an ecological natural process that promotes functions and values that are not readily replicated by man-made structures. These are incredibly complex systems that tend to cycle on a regular basis and that humans have yet to duplicate in ways that minimize risks to aquatic systems.

   There is an ongoing effort on the part of a large group of partner organizations including but not limited to the VDEC, the VFWD, The Nature Conservancy, the U.S. Forest Service, researchers from University of Vermont, and Keene State University, the U.S. Fish and Wildlife Service (USFWS), and many others, to explore options for promoting beaver created wetlands through a wide variety of means including analogs.

   In addition, the VFWD has worked with VDEC to develop Best Management Practices for dealing with Human Beaver Conflicts to address flooding, tree cutting, and downstream concerns related to beaver created wetlands. The VFWD has provided technical assistance, education, and beaver baffle installations for over 20 years to maintain beaver created wetlands in the face of conflicts with human infrastructure.